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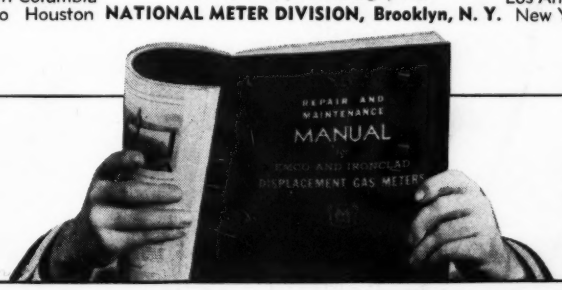
NATIONAL METER DIVISION, Brooklyn, N. Y.



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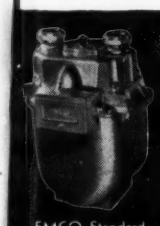
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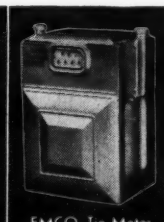
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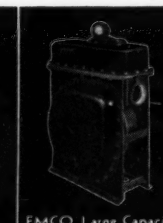
EMCO No. 4 Meter with EMCORECTOR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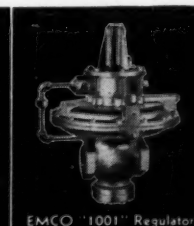
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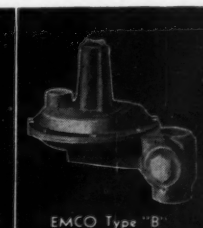
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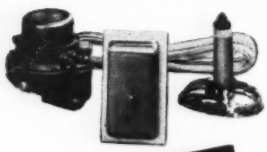
With a record of excellence in war production that won the Army-Navy "E", GENERAL CONTROLS announces with genuine pleasure its immediate readiness to serve the great Gas Industry. Shown here are some of the many proved products in one of America's most complete lines of temperature, pressure and flow controls.



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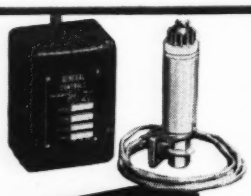

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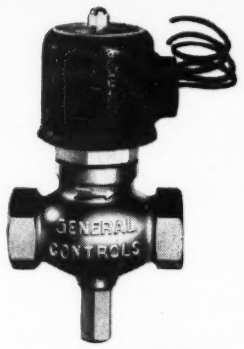

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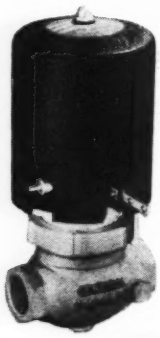

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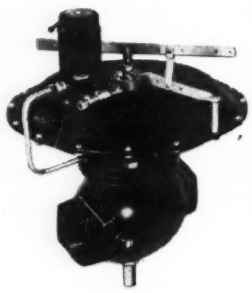

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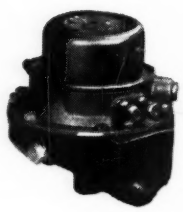

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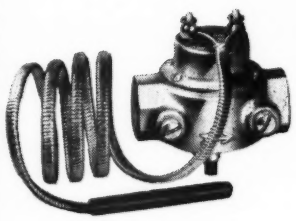

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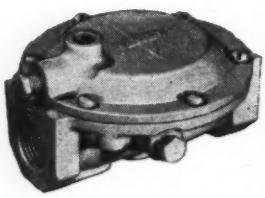

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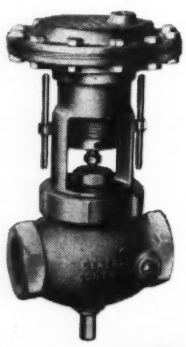

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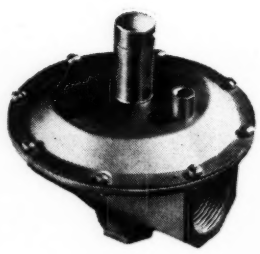

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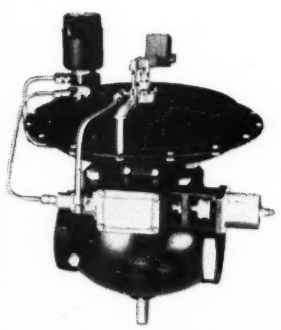

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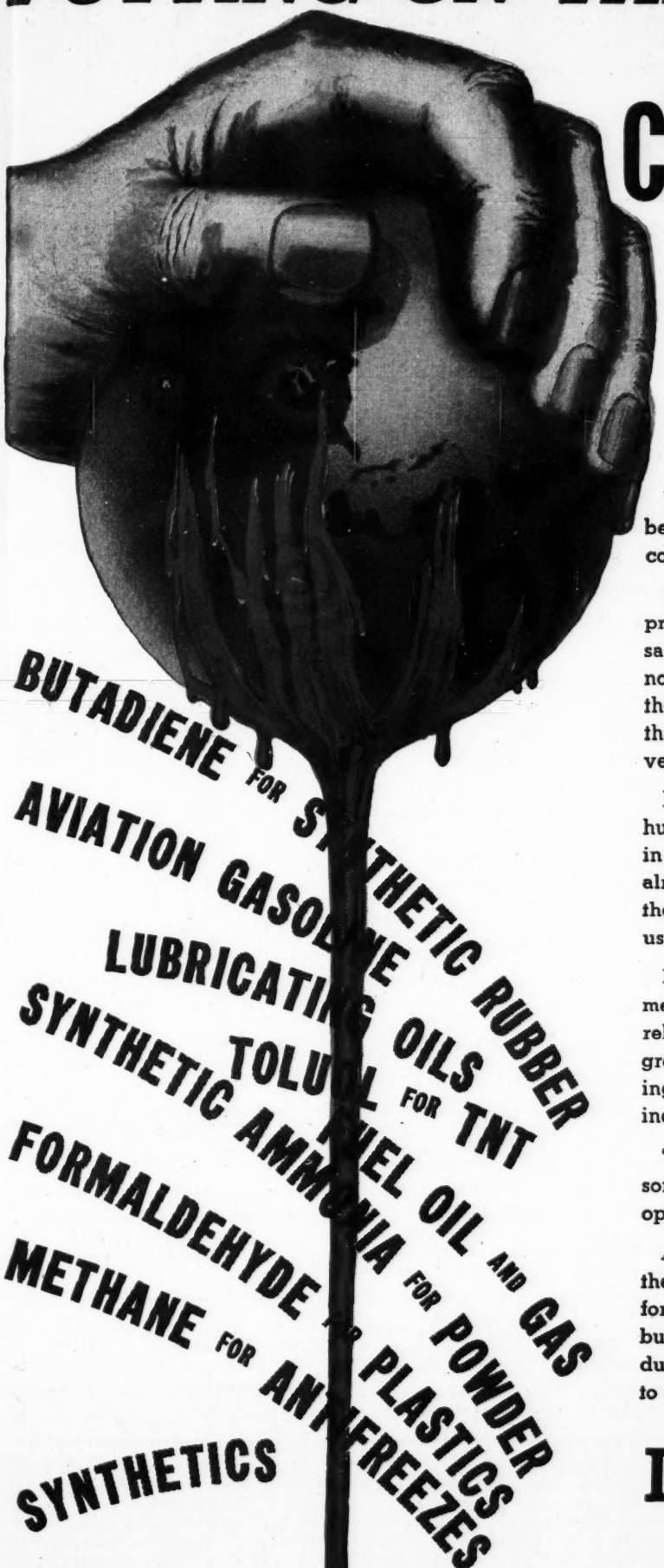
PUTTING ON THE PRESSURE *with* COMPRESSORS



Enormous quantities of raw gases and oils are being squeezed from the bowels of the earth and converted into many of the most vital war materials.

If you are a petroleum or chemical engineer or production man, you know the story, but it is a satisfaction to the rest of us to know that you are not bleeding old Mother Earth to death . . . that there will be enough left for future generations, so that they, too, can share the comforts and conveniences made possible by petroleum products.

By repressuring, you are prolonging the life of hundreds of fields for years to come; by recycling in distillate fields, you are taking gases that have already yielded much gasoline and are returning them under high pressures to the sands for future use.

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The heart of each of these phases is the compressor . . . one of the machines that must be able to operate continuously 24 hours a day, day after day.

And the name *Ingersoll-Rand* on so many of these machines, as well as their records of performance, will undoubtedly be the signpost to buyers in post-war expansion of this essential industry. In the meantime our engineers will be glad to co-operate in helping to solve your problems.

Ingersoll-Rand

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Twentieth Year of Publication

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GUEST EDITORIAL

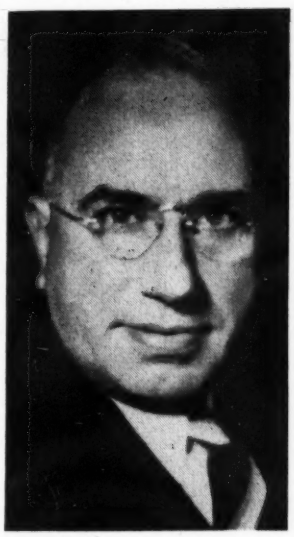
What Has Been Wrong
WITH OUR THINKING

By J. FRENCH ROBINSON
Vice President, American Gas Association

PLEASE note that I start with a question—not with the answer.

Maybe we can put it down as the first fact in any diagnosis of the American condition that for the past few years we have tried to work from an answer backward. The result has been that the questions have been made to fit the answers—which I submit, and not patiently, either, can not be done.

We can do good thinking where our own business is concerned. The world grants us that distinction. How, then, could we let our country and its social organization get into such a mess as we are in today? And that is the only word for it—mess. Up to our neck in wars all over the world, our domestic economy on the rocks, and a belated struggle under way to retrieve our fast vanishing birthright of a free America, we have to pinch ourselves to make us wake up to what happened to us. And even now we are half afraid to ask anybody in authority for the answers we are entitled to know. Timidity is one of the things that have ailed American business thinking.



Let's drop all timidity and cant and hypocrisy. They fool nobody. After all, this is our country, it belongs to us. To be precise, and also honest with ourselves, I am talking about the problems which beset us today. Those which vexed us yesterday were supposed to have been answered when we delegated their solution to the present administration in Washington—so overwhelmingly did the Americans turn that responsibility over to others, who asked for it, by the way, that these latter were pleased to give the transaction the color and even the name of "mandate."

To avoid errors of partial thinking, let us grant them their own name for it, and take them at their own word. It is our own thinking, the thinking that was responsible at bottom for what we have all around us today, that we are dissecting now.

Don't blame the other fellow. Maybe we would have done the same as he did had we been in his place. The same God made us all—and not much differently, I suspect. We can, however, and must and will, appraise what he *did* with the power that was delegated to him. Would we have done better, or done worse, than he has done? We do not need to answer that question. It is he and his new order who are on trial for what they did and are doing.

It is a common mistake in our thinking nowadays, and I am speaking as a businessman, that to remove one man and replace him with another is the answer. But I submit that this is not so and that such thinking is faulty, even though that one man be the exalted character in the White House, and even though the replacement be—anybody you might wish to think of. We waste too much time and mental energy trying to fix all our ills or all our blessings (according to which side you are on) on one man, or one group of men.

Nor do the two words "New Deal" make a sufficient base for our thinking, whether it be pro or con.

There is one vital issue now facing the American people, which is restoration of and the continuance of a people's government—what we call properly representative self-government, as established by the Constitution but, alas, not guaranteed by it. This last is up to us. Get that back and we won't have all—but we will have the best approach to it ever devised by mankind. The country will belong to its people, and government by the people shall not have perished from the earth.

While we are on the subject of the New Deal, so-called, let us remind ourselves, and with emphasis, that it is not new at all but as old as recorded history; that the principles have always been perfectly familiar and are a chart which, however imperfect, are as nearly perfect as such things can be. It is a chart which has been well worn by the usage of many centuries of mankind. The necessity of their present application is unquestioned by thoughtful men.

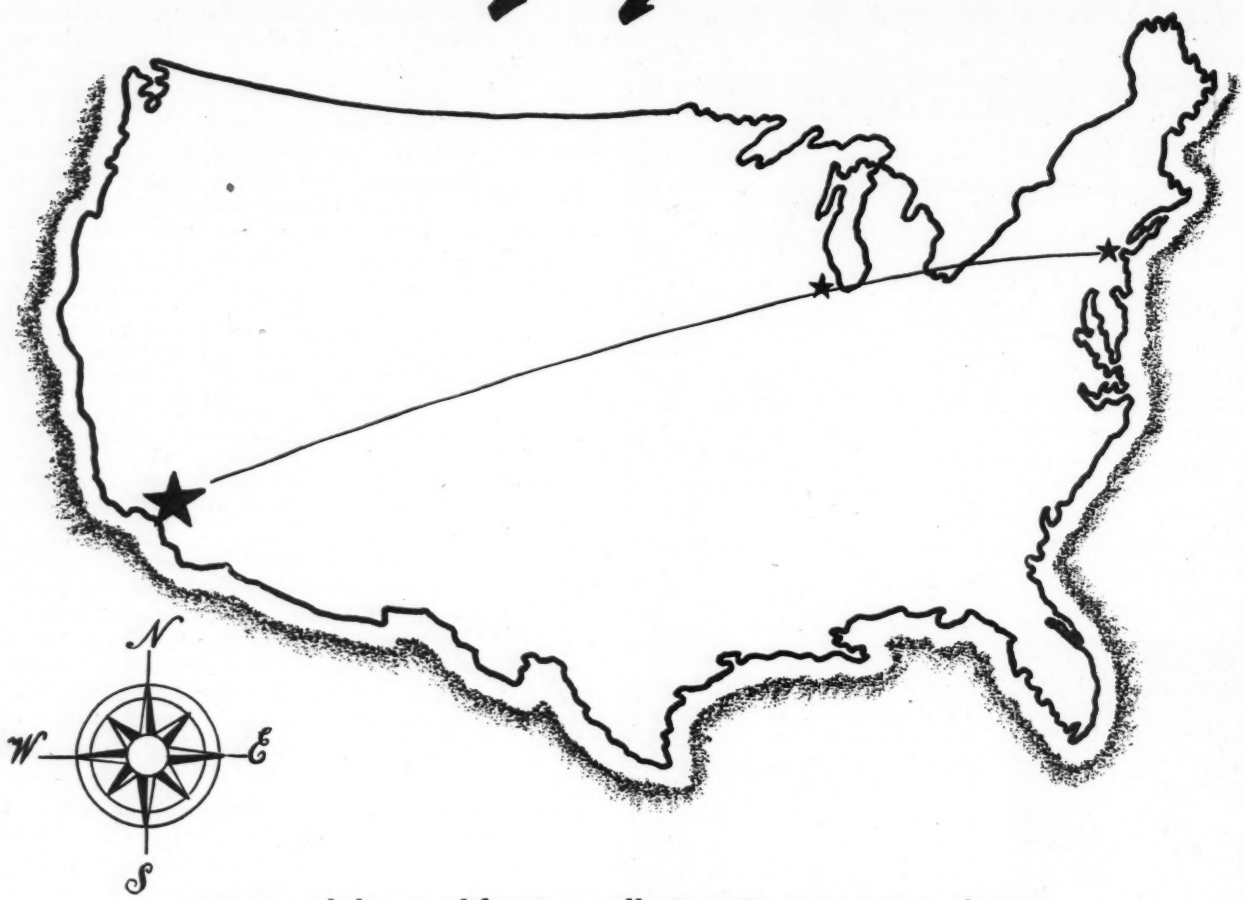
We Americans are self-deceived, to our own undoing, by our fondness for catch words and just plain gags for which we fall, principally, I suspect, because they take the place of thinking—and thinking is hard work. Words have come to mean too little. We should start thinking in terms of things, rather than their labels. We have not been so fortunate in our dependence on labels.

Seeing that we are scrutinizing ourselves and not the other fellow, let me suggest that if we had put more thinking on our country and into our country, and into what makes it click, even at the cost of doing a little less thinking on our bookkeeping and "production," the country would be better off today than it is. For, after all, it is our country in which we do our business and upon which our business depends. This, it seems to me, is an obligation we owe our stockholders, as well as being our patriotic duty.

Political thinking? By all means let us have more of it, even if we have to take time out of our so-called business to do it. I mean, of course, non-factional and non-partisan politics—politics in the real meaning of the word—the thing which the word represents. Politics in any form and in all of its good and bad qualities, is the essence of political government, unescapably. We can't avoid thinking politics, therefore. We can and should, I believe, enjoin upon ourselves the thinking of politics and the talking of politics openly—and righteously.

In conclusion, I will submit that the most important department of our business from now on, and the most important part of our thinking and our acting, is that which we know as our country.

Connelly goes West



Increased demand for Connelly Iron Sponge necessitates building a new Sponge Plant on the Pacific Coast

The emergency demand for Gas Purifying materials at the Southern California Gas Company's Butadiene plant has been met by Connelly Iron Sponge & Governor Company with the erection of an Iron Sponge Plant at Los Angeles. This new plant, established in record time, is additional evidence of Connelly's alertness and ability to meet the gas purification needs of the industry.

This new plant, together with our Elizabeth, N. J. and Chicago, Ill. plants, makes available to the Gas Industry a nation-wide, coast-to-coast gas purification service.

For over 65 years Connelly has worked closely with leading technicians in the field developing new methods and materials. If you have a gas purification problem, consult Connelly. The practical experience, accumulated field data and laboratory service are at your disposal. There is no obligation—call or write the Connelly Engineer.

CONNELLY IRON SPONGE & GOVERNOR CO.

200 S. Second St., Elizabeth 1, N. J. 540 Bauchet St., Los Angeles 12, Calif.
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Connelly IRON SPONGE

Thermally Thinking

By ELLIOTT TAYLOR, Washington Editor

Time Lag

SPEAKING to the distribution men in their recent conference in Cleveland, President Acker of the AGA observed that there is often too much of a time lag between the findings of committees and their use.

Mr. Acker was, of course, referring to the laboratory research and the other investigations and studies that are being made in connection with postwar problems. Without going into the fine points of distinction between fundamental and applied research, we believe that the investigations now under way in the AGA laboratories are the most stimulating and the most challenging that have ever been undertaken by the gas industry.

For the appliance manufacturers to make every attempt to utilize to the fullest the findings that are present to them in their new designs is just good sense. It is good sense if for no other reason than they are having a half million dollars' worth of research handed to them, and the more use they make of it, the more they are likely to find will be forthcoming from the same source.

Criticism

WE have been meaning to peel the hide off an old onion that has been sprouting in the handkerchief of more than one gas industry orator since way back when and before we lost the lighting load, the same being in the form of a weasling little argument that any kind of criticism that is inclined to be more in the nature of a diagnosis than a prescription is destructive rather than constructive and should never be indulged in.

This particular piece of advice hits us on our blind side because, in the first place, it seems generally to be advanced by someone who hopes for the soft pedal on a job that he is more than a little ashamed of; and, in the second place, its acceptance might tend to deprive the gas industry of periodic invitations to indulge in a little critical self-evaluation, without which progress is very slow indeed.

If a tender solicitude for its weaknesses ,and a melting adoration of even its mistakes, were all that the industry needed from its press, we would gladly devote our meagre talents to composing the periodical paneygrics that such a brand of journalism would require. But we believe that the industry and those who represent it are still robust enough to require treatment a little more stimulating than the dulcet blending of a mixed chorus of "yes" men.

There is only one infallible test of criticism—and that is whether or not it is valid and honest. If it is, then it doesn't make any difference whether it falls pleasantly or unpleasantly on the ears of those whose activities are under consideration.

Farewell and Hail

IT is not with any profound sense of impending deprivation that we bid farewell to the open-faced gazelle who, with her 4-F consort, has graced the full pages of American Gas Association advertisements in the national magazines since black October 1943 when the dream- or nightmare-world theme was first unfolded to the pitiless stare of an incredulous and baffled public.

In the past eight months, as the gas industry's conception of the homemaker of tomorrow, she has lounged and lolled and slumbered and slouched her way through seven separate scenes, a merciful reduction of one from the eight insertions that originally were scheduled in the series. It is heartening to note that for her last appearance, in a trapez act, which is, of course, easily identified as symbolic of "gas, the magic flame that will brighten your future," the heroine finally has pulled herself together, got up out of bed, boudoir, beach and bath, and put some clothes on for the final curtain.

While we remain convinced that the effort has done little to advance the cause of gas in the minds of a realistic public, we feel that the campaign, by the very controversial nature of its whole conception, has brought the subject of national advertising to the attention of more gas men than ever gave it any thought in the past. This can be constructive to the whole cause of national advertising, since we note that even the severest critics of the clap-hands and dream approach never regarded this unfortunate experience as reason or justification for abandoning the effort. On the contrary, we have seen ample evidence of a strengthening conviction that once the present nonsense is over with, it will be high time for the gas utilities to buckle down to a real campaign, with real financing behind it, and, what is even more important, with real brains and talent incorporated in its preparation. It is not productive of a good campaign to throw the whole matter into the lap of an advertising agency, accept blindly the first, or second, or the twenty-first, suggestion that some of its bright young men have to offer and then consider the matter taken care of for another six months. And utility executives who thus shirk their responsibility have little cause for complaint when they wake up to discover that they bought little else but bad taste and buffoonery for their advertising investment.

We believe, too, that the industry is about ready to give up the experiment of sending out a boy to do a man's work, and that future advertising campaigns will have enough financial backing to enable them to climb up into a class with the competition. We go back to the words of Frank Smith of Houston who satd, "Instead of a half million dollars, our sights might better have been set on $4 million" (per year for national advertising).

There is talk now of a super promotion effort for gas to be undertaken in the immediate future with the possibility of a separate organization and regional directors set up to function under the general supervision of the AGA. But no matter what auxiliary activity is undertaken, it cannot supplant, but on the contary, must be co-ordinated with, an expanding program of national advertising.

If the committee on national advertising has spent a half million dollars to shock the industry into a realization that good presentations don't come cheap, and don't come by accident, it has made a good investment of the funds entrusted to its care. And the innocent evil that the prophetic dream girl may have done can be forgiven and forgotten, since nobody but a trained psychiatrist could make out what the hell she was driving at anyway.

● **Bendability, strength and toughness** of DEOXIDIZED Bessemer Seamless Pipe are illustrated here. Three tractors and a dragline on a barge are pushing this weighted section of 12¾" O.D. pipe across a lagoon in Louisiana. The longest shove made was 22,352 feet. In spite of the large number of 1500-pound concrete weights, the pipe showed no ill effects from this added load.

● **Superior welding qualities.** Because of the low carbon content of DEOXIDIZED Bessemer Seamless Pipe, it speeds up welding operations and assures better welds.

Note these Important Characteristics

In the following features, comparisons have of necessity been made with basic open-hearth steel of the *same tensile* strength. This has not been done to minimize the well-known features of that steel, but to indicate how, in the case of certain applications, DEOXIDIZED Bessemer steel offers definite advantages.

★ **Permits higher design or working stresses** because ratio of yield strength to ultimate strength is considerably greater.

★ **Better welding qualities** because of low carbon content.

★ **Lasts longer** under dynamic conditions of loading. Has a higher "endurance limit."

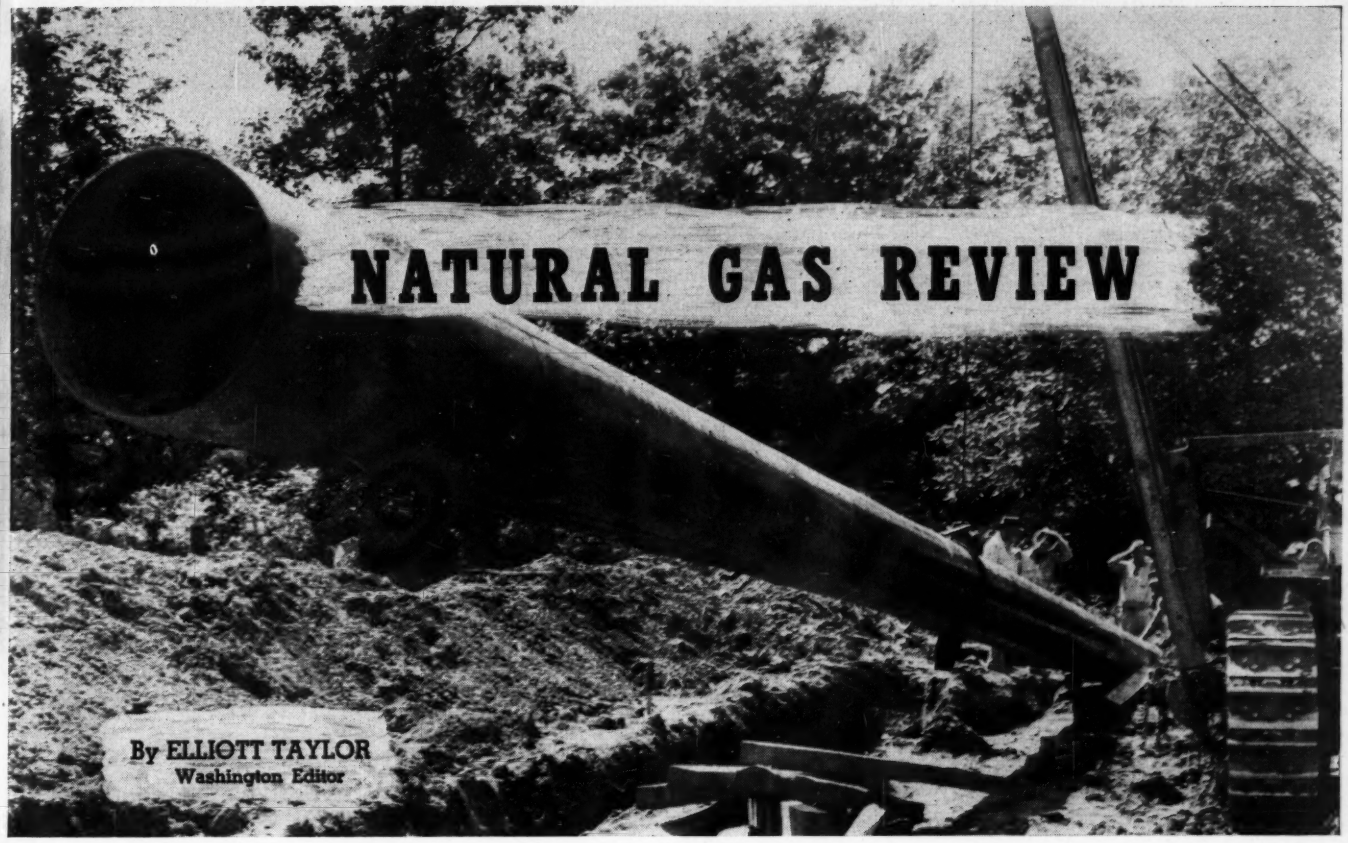
★ **Ductility and toughness** are fully equal to those of steel of the same tensile strength.

★ **Ideally suited for bending.** Has higher resistance to failure by buckling. Permits higher design loads.

★ **Fine grain structure.** Minimum of inclusions. Is cleaner.

● **Dependable.** No chances can be taken on pipe when it goes into underwater service. DEOXIDIZED Bessemer Seamless Pipe has already been proved safe and dependable in jobs totaling hundreds of thousands of tons.

U N I T E D



NATURAL GAS REVIEW

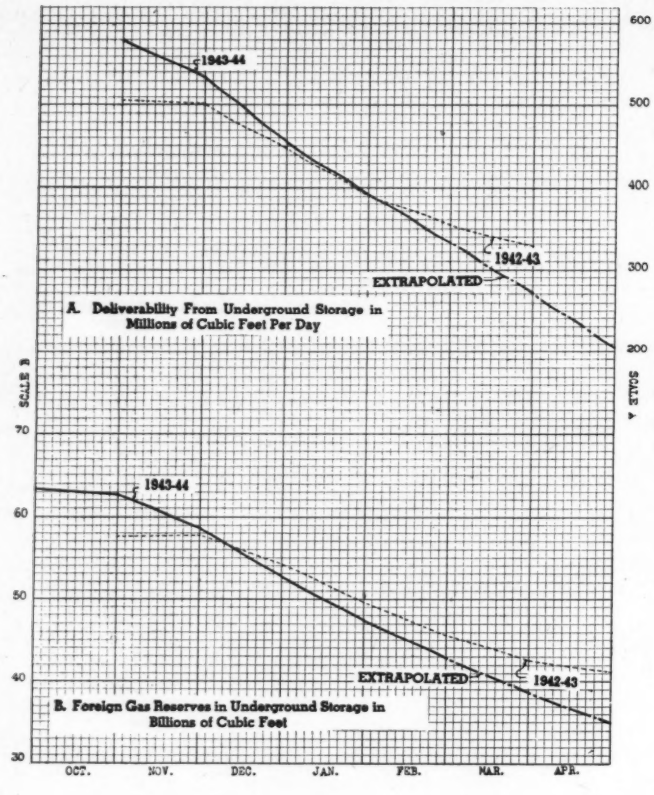
By ELLIOTT TAYLOR
Washington Editor

THE natural gas industry has negotiated the difficult 12 months that have elapsed since the 1943 Natural Gas Management Conference in Cincinnati with a record that continues to be greatly to its credit. It has held up its end of the fuel requirements of wartime production and essential civilian consumption in a manner that has not been even approximated by either the oil or coal industries. It has taken care of the inevitable increase in sales per meter to both domestic and commercial classifications that comes with more spending power available in the hands of the public, and it has done it without service failures and without recourse to either official or informal rationing. It has maintained harmonious and cooperative relations with the two wartime agencies who have temporary jurisdiction over its physical operations, the Office of War Utilities of the WPB and the Natural Gas and Natural Gasoline Division of PAW. It has put up an intelligent and successful fight for its legitimate rights to some relief from excess profits taxes. It has taken due cognizance of changing social and political patterns as evidenced by FPC and state regulatory orders and decisions of the United States Supreme Court and is moving to adapt itself to the new conditions that they bring about.

Statistics released at year's end by the American Gas Association show that the total number of natural gas customers increased during 1943 only 2.8% over 1942, while the total gas sales went up 12.2%, and revenue in dollars increased 8.5%. The total amount of natural gas delivered in 1943 was 1,983,397,000 Mcf, an increase of 215,673,000 Mcf, over 1942. It is worthy of note that this increased sendout was largely achieved by using to maximum capacity already existing transmission facilities, and by adding to storage supplies in critical areas; for the Panhandle Eastern Pipeline Co.'s looping project from the Texas Panhandle to Michigan and the interconnection with the properties of the East Ohio Gas Co., combined projects designed to carry an additional 88 million feet of gas per day out of Texas were not in full operation until January of 1944. And the trans-Oklahoma line of the Cities Service Transmission and Chemical Co. to bring 140 million cu. ft. per day from Hugoton Field to distribution systems in eastern Kansas, northeastern Oklahoma and western Missouri was not completed until the spring of 1944.

This record, accomplished in the face of continued shortages in material and an onrushing manpower crisis that continues to grow steadily worse, must be credited in the main to two factors. The first of these has been the intelligent handling of company and industry problems by the industry itself as these problems arose, on the ground and at the time when immediate action was necessary to save the service. Instances could be cited from New York to California where individual gas companies by voluntary act drew on their own depleted storage to pass gas along to others whose supply situation was at the moment more critical than their own. To mention but one of many such examples: The New York State Natural Gas Corp. during the winter gave up approximately 1.5 billion feet of gas without compulsion or order, to an interchange pool that saved the day in the Appalachian area. For here, in the tightest gas situation in the nation, for the winter of 1943-44, the continuing decline in available supply from the Oriskany field was further aggravated by what was probably the highest average per meter sale of gas in the history of the area.

The second factor responsible for the successful negotiation of this critical winter was, of course, the brilliant record of coordination of all natural gas operations that resulted from the combined efforts of the Natural Gas Division of OWU and



Underground Storage in Appalachian Area (New York, Pennsylvania, Ohio, W. Virginia).

the Natural Gas and Natural Gasoline Division of PAW. Any evaluation of the progress of the industry for the past twelve months that failed to take these two vital and cooperative agencies into account would be incomplete to the point of unfairness. So long as wartime conditions prevail both OWU and PAW are as much a part of the natural gas industry as any pipeline or distributing company in the directory. And the simple fact that the gas industry stands alone among fuel purveyors as the one that did not fall down on the job at some time, in some place, during the past winter is as much a tribute to Paul Taylor and James Pew and their respective staffs as to any executives or operators in natural gas ranks.

Regulation Minimized

Noteworthy is the fact that during the past year there has been an attitude on the part of OWU to minimize the amount of categorical regulation under which the industry has had to operate, replacing it by the reliance on individual judgment and operating sagacity of gas men who are most intimately acquainted with their own local problems. Orders have been simplified and clarified, and the amount of burdensome reporting of details of operations is being steadily reduced.

In October utilities order U-7 superseded WPB L-31, and among other provisions brought non-utility suppliers of gas under the jurisdiction of OWU. Residential space heating limitations were changed over from the type of equipment used to a Btu input basis; curtailment procedure was clarified and gas system reporting forms simplified. Subsequent administrative letters pursuant to U-7 have been designed to simplify the procedure involved in permitting the delivery of gas for industrial and domestic uses by giving advance approvals for many types of installations without the necessity of obtaining advance approval on each specific project.

As the natural gas industry entered the winter that has just passed, it was early recognized that the critical danger spot was in the Appalachian area, a fact which had been since early fall a matter of grave concern to OWU. The local gas supply, largely from the Oriskany field has been in a continued and rapid decline for years. Increased drilling operations under the aegis of relaxed drilling restrictions on the part of PAW during 1942 had resulted in adding to the daily deliverability, gas in excess of 100 million cu. ft., but this was not sufficient to offset the decline in production of the old field aggravated by the increased demand for gas from the highly concentrated industrial operations in the area served.

In August 1943 an order had been issued for the area making mandatory the conversion, wherever feasible, of all gas fired boilers, consuming over 100,000 cu. ft. per day, to other fuel. It is estimated that 85% of all equipment of the type to which the directive applied was converted to coal or oil, with a saving in natural gas of 10 billion cu. ft. per year. In November, December and February 1944, directives issued ultimately prohibited the use of gas in any industrial plants where standby equipment was available for any substitute fuel except liquefied petroleum gas. By the first of March, this year, gas reserves in underground Appalachian storage had dwindled to 43 billion cu. ft., as compared to nearly 46 billion reserves in the area on the same date in 1943. This was true in spite of the fact that the season started out with six billion cu. ft. more stored underground than was available the previous year.

It is now estimated that the withdrawals of foreign gas reserves from underground storage in the Appalachian area will total nearly 28 billion cu. ft. for the six months from November 1, 1943 to May 1, 1944. One of the 1944-45 problems now confronting OWU is how to build back this reserve to the necessary minimum of 65 billion cu. ft. during the summer months that lie just ahead.

In California where the general fuel situation was handled with the primary objective of saving a maximum amount of oil, both gas and oil were used to their fullest availability, and an all-time high demand late in December resulted in two sharp curtailments in natural gas usage to industrials but the overall situation did not become serious and there was no breakdown in essential service.

Use of interconnections previously installed and substantial withdrawals from storage during winter peaks were sufficient to furnish all essential natural gas requirements in the critical Oklahoma, Kansas and Missouri area.

Construction

New pipe lines built during the past 12 months have already been mentioned, the principal ones being: Panhandle Eastern Pipe Line Co. looping project, an $11,000,000 job calling for 30,000 tons of steel which by the end of January 1944 was delivering an added 88 million cu. ft. of natural gas per day of additional

gas into the Panhandle system; 120 miles of 20 in. line of the East Ohio Gas Co., running from Toledo to Cleveland, and carrying 50 million feet per day of additional gas into the Cleveland market in full operation the first of the year; the Cities Service Transmission and Chemical Co.'s 240 mile 24 in. line from Hugoton field across northern Oklahoma to Blackwell, Okla. to augment supply to the eastern Kansas shortage area by 140 million cu. ft. per day. On the last named line, additional compressor facilities to be installed are expected to step up the deliverability to 215 million feet per day before next winter.

Other important projects have been authorized by the WPB and are now either under construction or soon to be started. The most important of these is of course the 24 in. Tennessee Natural Gas and Transmission Co. pipe line from Texas to West Virginia, a distance of 1228 miles. Pipe delivery and construction were up to schedule as of the middle of April, and present expectations are that the $50,000,000 project will be completed in October. Also authorized by WPB early in 1944 was 200 miles of 8 to 18 in. line for the Kansas Nebraska Natural Gas Co., to take Hugoton gas into north central Kansas and central Nebraska, supplementing the depleted supply of the Otis field. Cities Service Gas Co. will build 35 miles of 16 in. line from Blackwell to Burbank, Okla., to increase deliverability into the east side of its system. WPB approval and priority assistance has also been extended to increase pipe line capacity north of Pittsburgh, Pa., and to further aid northern Pennsylvania and south central New York state on projects involving looping, by the Manufacturers Light and Heat Co., and 145 miles of line to be laid by the New York State Natural Gas Corp. and the Hope Natural Gas Co.

In California both the Pacific Gas and Electric Co. and the Coast Counties Gas Co. have had looping projects approved to bring 100 million feet of additional gas per day into their systems from the Rio Vista field in northern California. Also approved in March was a 104-mile, $4,000,000 line between La Goleta dry gas field and Los Angeles to be built by Southern California and Southern Counties Gas Cos. The Memphis Natural Gas Co. will also complete looping of its system from the Monroe field in Louisiana to Memphis, adding 45 miles of gathering line to bring in supply from the Lisbon field, west of Monroe, increasing deliverability in the Memphis area by 22 million feet per day.

A total of 400,000 tons of pipe will be required during 1944 on WPB rated projects for new construction already approved.

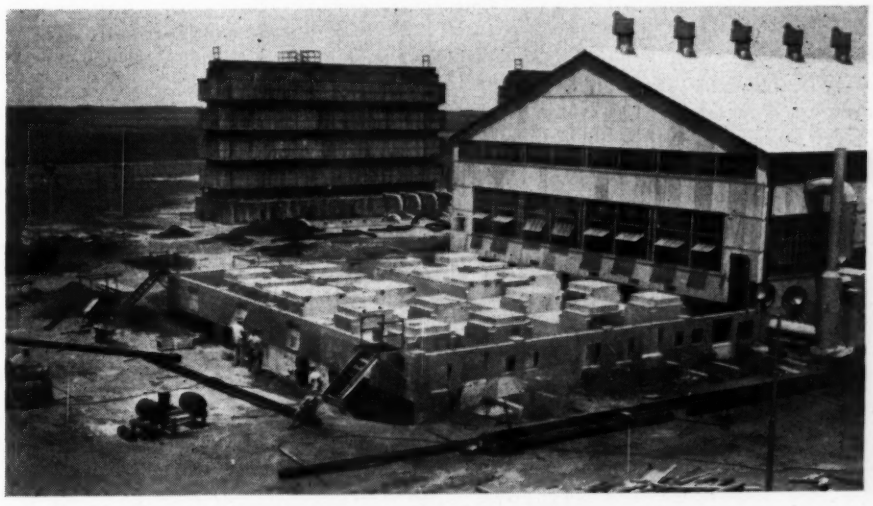
Regulation

Since last May natural gas industry relations with official Washington, aside from those with the war agencies just discussed, have had little to distinguish them from those of other years. The Supreme Court has in the main continued to interpret the law in the light of newdealism, a phenomenon not to be marveled at since most of its appointees of the past decade have been put in for that purpose. Its decision in the Jersey City Power and Light case, giving the FPC jurisdiction over what had always been regarded as a strictly intra-state company, resulted in a minor revolt on the part of the National Association of Railroad and Utility Commissioners in which the state commissioners recommended that national legislation be enacted to keep the federal agency out of state regulatory affairs.

The decision against the gas utility in the Hope Natural Gas Co. case was generally regarded as a setback for the utility-favored principle of reproduction cost as a base for rate-making. But in the months since the decision was rendered, state regulatory bodies have shown little inclination to join in a rate reduction switch hunt such as was anticipated by Leland Olds, chairman of FPC.

In recent years natural gas utilities have shown an increasing disposition to settle rate disputes with FPC and the state commissions by negotiated agreement, a trend that was continued during the past 12 months. Following the Hope decision the Peoples Natural Gas Co. of Pittsburgh settled its seven-year-old rate case by agreement with the Pennsylvania Public Utility Commission, on the basis of an offer made by the company to reduce rates by approximately $221,000 per year, and to refund $500,000 to its consumers. There are presently eight interstate rate investigations under way at FPC, and the commission intimates that these will about keep its hands full until after the war is over, although it has announced that it will "continue to entertain and to handle to the best of its ability any reasonable requests for rate adjustments."

OPA which had been nibbling hungrily at the fringe of rate-making authority over all public utilities has not fared well in the gas industry. This ambitious agency hastily put a new complexion on its activities as a result of the president's "hold the line" order of April, 1943. On April 12 it filed a brief in support of the city of Detroit which was seeking a reduction in electric rates from the Detroit Edison Company. The Michigan Public Service Commission subsequently—in July—denied the petition of the City of Detroit and overruled the pleas of OPA favoring such a reduction. Other rebuffs administered to OPA were at the hands of the Wisconsin Public Service Commission in the Milwaukee Gas Light Co. case and the Public Service Commission of Indiana in the Eastern Indiana Gas Co. rate increase. The administration had better luck however when the Kentucky Public Service Commission denied a rate increase



Building walls and foundations for two 1300-hp. Cooper-Bessemer engines, Greensburg Station, Panhandle Eastern Pipe Line Co.

Placing one of the four 10-in. manifold lines at Maumee River Crossing, East Ohio Gas Co. pipeline project.

sought by the Western Kentucky Gas Co., on the basis of the "hold the line" argument advanced by OPA.

That the OPA has overplayed its hand in intruding on established regulatory bodies and rate-making procedure was finally established when in March 1949 the United States Supreme Court ruled in favor of the Washington Gas Light Co. and the D. C. Public Utilities Commission and against OPA. OPA by a series of legal maneuvers had sought to overthrow the sliding-scale profit-sharing plan by which Washington gas and electric utility rates are set, to the end that the gas company might be denied an automatic increase in rates due it under the plan. The court in effect said that the regulatory commission had the right to handle its own procedure within the framework of the specific laws under which it operates. The net effect of the Washington case may be to discredit OPA interventionists in the eyes of other regulatory bodies who have state laws and state court decisions to take into account, a fact which the OPA has consistently overlooked.

Relief from certain provisions of the excess profits tax for natural gas producing and pipe line companies was written into the controversial tax bill that was passed by Congress, vetoed by the President and promptly passed over his veto. Credit for the presentation of the case to Congressman Disney of Oklahoma, who introduced the measure, goes to a group of midwestern natural gas executives who worked on their own time and at their own expense to have it finally incorporated in the tax bill.

The city of Detroit has taken the lead in attempting to divert some of the excess profits taxes of operating utilities into the municipal treasury rather than to Washington. An ordinance calling for a 20% direct tax on the Detroit Edison Co. and the Michigan Consolidated Gas Co. was passed last December and is at the present writing being contested in the courts by the electric company. Since gas distribution property is not relieved of the burden of excess profits tax by the provisions of the new federal tax law, there is in many cities a sizable source of revenue that may be viewed with hungry eyes if this ordinance is upheld by the courts.

Associations

Yielding to growing pressure from the natural gas segment of its membership, the American Gas Association adopted constitutional amendments that set up a Natural Gas Department and a Manufactured Gas Department, each to be handled by a vice-president of the association. The managing committee of the new Natural Gas Department met in Cleveland in February and recommended: that the head of the Natural Gas Department should be an assistant managing director of the AGA; that a natural gas engineer be added to the staff of the director of the Natural Gas Department; that the statistical department be brought up to date. As of April 16 the head of the Natural Gas Department has not been selected and as a result the balance of the plans of the managing committee have been held in abeyance. In the meantime some minor reshuffling of the functions of the existing headquarters staff have been accomplished at the association's headquarters. Statistics on natural gas operations have been brought up to December 31, 1943.

In the early summer of 1943 the AGA approached it affiliated association, the Association of Gas Appliance and Equipment Manufacturers, with the suggestion that the AGA Laboratories in Cleveland should embark on a more ambitious program of applied research in domestic gas appliances. The manufacturers group was lukewarm to the proposal but promised to review each project as proposed and make recommendations on each individually. With or without specific AGAEM approval, the laboratory has proceeded since then with a program of domestic gas research accelerated, according to AGA President Ernest R. Acker, by 400% in 1943. Two general meetings, one in Cleveland and one in Los Angeles in recent months have served to acquaint the utilities as well as the appliance industry with the nature and the progress of the work that is under way. While fundamental differences of opinion still exist between utilities and appliance manufacturers as to the extent and the degree of research that the laboratory of the association should undertake, it seems to be generally agreed that technical investigation into domestic gas equipment, design and performance is a desirable wartime project and the AGA laboratory has taken the leadership in this type of work largely by manufacturer default.

Conferences between executives of the middle west natural gas companies, originating in their mutual interest in the question of relief from excess profits taxes, led to discussion of the advisability of forming a natural gas association separate from the AGA. These discussions culminated in the organization of the Independent Natural Gas Association of America, in January 1944. Membership in the organization is open to natural gas producers, royalty owners and pipeline companies anywhere in the United States. The independent association plans to establish a Washington office to represent natural gas interests before legislative and administrative bodies.

Dissatisfaction within the ranks of the Association of Gas Appliance and

Equipment Manufacturers came to a head early in 1943 and led to the reorganization of the manufacturers group. H. Leigh Whitelaw replaced William Berghorn as managing director and Leonard Macomber was employed as Washington representative.

Following the appointment of Mr. Macomber there was a noticeable increase in the Washington activities of the association and a weekly letter was instituted to keep the trade informed on governmental policies and orders that have a bearing on the manufacture of gas appliances and equipment. The CP range campaign which had been in a semi-dormant state since the outbreak of the war was taken down and dusted off as a sort of pre-postwar activity to get applianee merchandisers, the architectural profession and the future gas range customers thinking again in terms of certified performance. Utility response to the invitation of the CP range committee to cooperate has been in the main disappointing.

Future

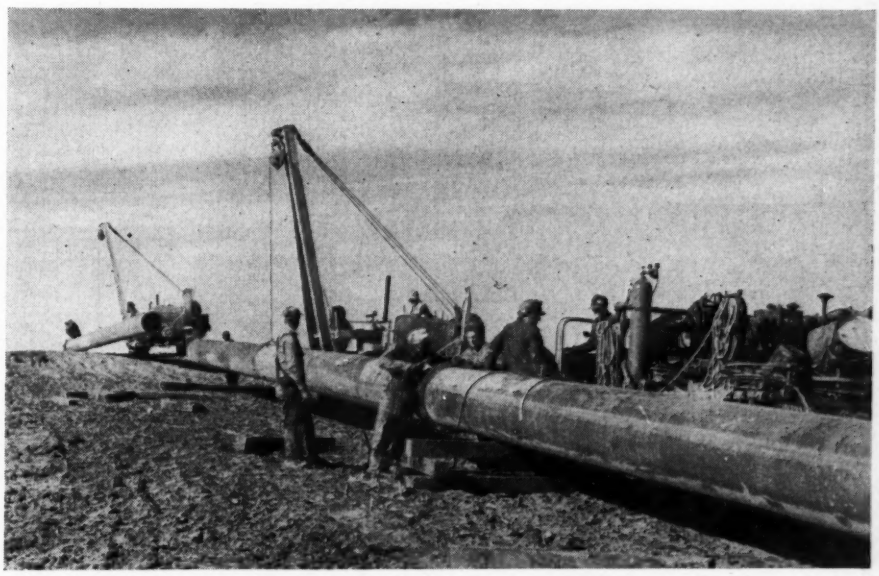
The future of the natural gas industry is not as uncertain as it is categorically unpredictable. Forces, sometimes apparent and sometimes obscure, are at play that will in sum add up to a weighty influence on its destinies following the war. Political considerations, economic and social trends, technological changes all are destined to have a direct and casual relationship to natural gas progress and development.

Political considerations veer with the changing of politicians' personal fortunes. The hardship and depression that wafted newdealism into power and kept it there for 12 years, has subsided in war prosperity; and good times are progressively proving the undoing of those who fattened their prestige on the lean scraps of national poverty. The great indispensables of national affairs now find themselves in the eyes of the voters as expendable as G. I. rations; and they cling on, when indeed they are able to cling on, only by the strength of their noisy appeal for support of the war effort.

Yet the legacy of social and economic change that to many has been identified as newdealism will remain, and it is with these factors that natural gas utilities must conjure as they ponder their future. Correlated to the broad problem of conversation of national resources is the question of natural gas expansion into new areas and for new uses in those territories that are already being served. New pipelines can easily be built and financed out of the exploitation of existing fields. But will the type and character of load necessary to make those lines economically feasible be regarded as in the public interest? The governor of Texas, and congressmen from other gas producing midwestern states are clamoring for a policy that will prevent the exportation of any additional quantities of gas into far-away markets. Justice Jackson of the United States Supreme Court in his comments on the Hope decision said: "In my opinion the 'public interest' requires that the great volume of gas now being put to uneconomic industrial use should either be saved for its more important future domestic use or the present domestic user should have the full benefit of its exchange value in reducing his present rates." With an eye to possible congressional expansion of its powers under the Natural Gas Act, the Federal Power Commission has said: "The Commission is keenly aware of the importance of conservation and the serious problems raised by the continued construction of large natural gas pipe lines . . . inasmuch as Congress has not given it (the FPC) . . . powers to deal with the end uses for which natural gas is consumed . . . it was the duty of the Commission not to seek to exercise such authority until the Congress amended the Natural Gas Act . . ."

It has been estimated that the equivalent of 300 million cu. ft. per day will have to be imported into the Appalachian area if the present forseeable fuel demand is to be met with natural gas. Southern California is already looking toward western Texas as a possible supply to augment its own production. Talk of converting to a gas carrier the "big inch" line now carrying oil to the Atlantic seaboard is frequently heard. Yet in all probability the consideration of problems of national rather than financial economics will be the center around which the ultimate fate of these projects will revolve.

Phenomenal developments in the synthesis of hydrocarbons into products hitherto unknown are destined to exert a profound effect on the future of natural gas. How many of the new synthetic products now touted in advertisements promising postwar miracles will materialize as commercially and economically practical it would be difficult to say. But there is even now evidence that those whose future use is assured will rely heavily on natural gas as a basic source of chemicals rather than a fuel. These uses spell increasing demand for gas, to be sure, but those factors whose interest are concerned with its transmission and distribution as a fuel find that the new industries will indeed go to the source of their raw materials, as the gas producing states now hope that they will, and aspire to compel them to do. The problems of royalty holders and gas producers primarily allied with the oil industry may tend to become increasingly divergent from those of the strictly natural gas utilities, as foreseen by the companies who have already affiliated with the Independent Natural Gas Association.



Laying 26-in. pipeline by the stovepipe method on the recently completed carrier of Cities Service Transportation and Chemical Company between Hugoton Field, near Guymon, Okla. to Blackwell, Okla.

NATURAL GAS PRODUCTION IN CANADA

By ROBERT CLARKE

GAS Correspondent

ONE of our common figures of speech is to say that a person has "money to burn," and this North American colloquialism can be applied literally to what has occurred in Canada's natural gas fields during the past 20 years. In that time, spectacular waste gas flares have burned billions of cubic feet of this natural source, which would have been worth millions of dollars to well operators had a market been available.

Of course, this method of disposing of excess gas is not common to all of Canada's gas-producing provinces. But it has been in effect at the country's greatest gas producing area—the Turner Valley fields in the Province of Alberta. Gas has been burned in the air simply because there has been no other means of disposing of the Valley's huge production. The wastage now is running at about 70 million cu. ft. a day, but back in the boom years of 1929-30 it was as much as a half billion cu. ft. daily.

Transmission Problems: Geography and the census figures underline the problem which Turner Valley has faced. Canada has a population of only 11,500,000 for all its great area, and the country's largest cities such as Montreal (pop. 890,234) and Toronto (pop. 667,457) are in the east, while the Turner Valley fields are in the west. Periodic proposals that Turner Valley gas be piped to some of the larger western cities never have passed the talking stages for a number of reasons.

Vancouver is one of the cities which has been interested in such a project. But British Columbia's largest city (pop. 271,000) lies 650 miles away and the pipeline would have to be threaded through the lofty Rockies. Interest in the proposition died out when estimates of the cost of the pipeline were received. Proposals to pipe gas to Winnipeg, the capital of Manitoba, 380 miles away, and to Regina, capital of Saskatchewan, 575 miles distant, also failed to materialize.

Producing Areas: Canada's four gas-producing provinces are Alberta, Ontario, New Brunswick, and Saskatchewan (ranked in output in the order named). The non-producing provinces are Manitoba, Prince Edward Island, Nova Scotia and Quebec. Gas has been found in the northern section of British Columbia, where drilling now is under way, but not in sufficient quantity to be marketed. Canada's government statistics for natural gas production also include the output in the Northwest Territories. but this small quantity has been used only for power purposes.

Canada's natural gas production for 1943 was slightly more than 43¼ billion cu. ft., valued at $11,699,894, and, as in the past, wells in Alberta and Ontario will provide 98-99% of the amount. In 1941, the figure was 43½ billion cu. ft. while in 1942 it was nearly 44 billion.

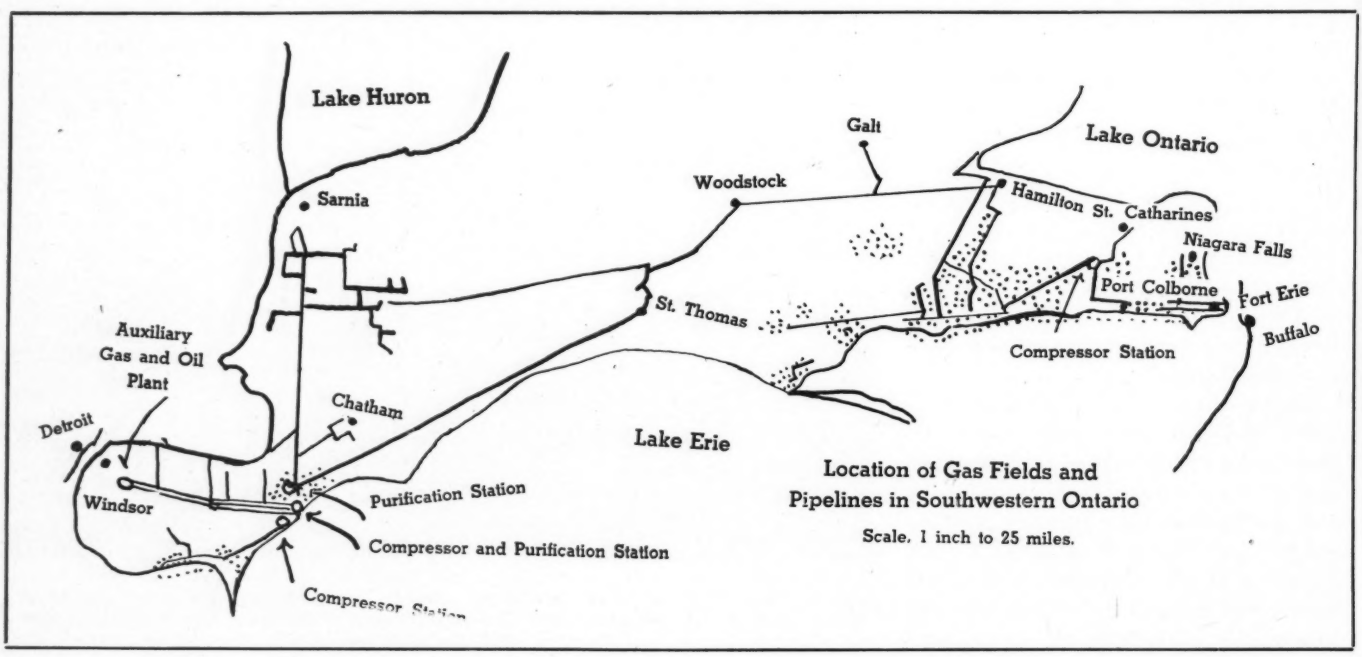
And now, here is the picture by provinces:

Alberta: Pipe-line hauls in Alberta are short since most cities and towns are located virtually on top of natural gas fields. This is particularly true of Medicine Hat, where street lights are allowed to burn all day because the city discovered it was cheaper that way than to have to pay men to extinguish and then re-light the gas lamps. Approximately 2700 customers are served in the city.

Industrial and domestic users in the past few years have consumed from 25 to 33 billion cu. ft. of Turner Valley gas. There are slightly more than 25,000 consumers in Calgary (35 miles northwest of the fields), Lathbridge and surrounding areas, while a considerable quantity of gas is used in the field for drilling purposes. Some 13,500 customers in Edmonton derive their natural gas from the Viking field, which is 80 miles southwest of the city.

The Alberta Petroleum and Natural Gas Conservation Board, incidentally, has under consideration a plan to eliminate gas wastage which will be discussed later in this article.

Ontario: Natural gas production in Ontario, confined to the southwestern part of the province, has shown a decrease in recent years. A. R. Crozier of Toronto, acting Commissioner of Gas for Ontario, reports that the decrease may be accounted for by the



Location of Gas Fields and Pipelines in Southwestern Ontario

Scale. 1 inch to 25 miles.

depletion of gas fields and the failure of exploratory drilling to develop new sources of supply, rather than any lack of demand for natural gas.

From 13 billion cu. ft. in 1940, production has declined until Mr. Crozier estimates it will approximate 8 billion cu. ft. in 1943. According to Mr. Crozier, approximately 130,000 homes in Ontario use natural gas. Largest city in Canada to be on a 100% natural gas basis is Windsor (pop. 105,000), just across the border from Detroit. Other Ontario cities making exclusive use of natural gas include London (78,000), Niagara Falls (20,000), Brantford (31,000), St. Catherines (30,000), Chatham (17,000), and Sarnia (18,000).

Mr. Crozier reports that in 1943, at the instigation of the Ontario government, the Randall Co. of Parkersburg, W. Va., conducted seismic surveys in the province in an attempt to discover new fields. It was necessary to have a United States firm do the work, says Mr. Crozier, because no adequate equipment is available in Canada.

New Brunswick and Saskatchewan: These provinces can be grouped together, since their combined production is small compared to that of Alberta and Ontario. Saskatchewan's small deposits, producing slightly more than 100-million cu. ft. are in the vicinity of Lloydminster, which is on the Alberta - Saskatchewan border. The output is used principally to supply customers in Lloydminster. The Stormy Creek field is the main producer in New Brunswick, where the output is slightly more than 600 million cu. ft. yearly. Approximately 6400 customers in the city of Moncton and surrounding villages are supplied from the Stony Creek wells.

A search for favorable natural gas and oil structures in the Canadian province of Saskatchewan has revealed that there are great possibilities, since nearly every well that has been drilled to reasonable depth has shown some indication of gas or oil, according to the annual report of the Department of Natural Resources tabled in the Saskatchewan legislature Feb. 22 by Hon. W. F. Kerr.

The department report reveals that a total of 114 wells were drilled in the settled part of Saskatchewan (120,000 sq. mi.) during 1942-43, with a definite intent of investigating for gas or oil. Of that total 46 were less than 500 ft. deep, and the depths of the other test wells ranged from 1000 to 7000 ft.

Conservation: As has been mentioned previously, the Alberta Petroleum and Natural Gas Conservation Board has been devoting a great deal of attention to save gas hitherto wasted. The plan was suggested by Thomas Weymouth, consultant on gas conservation to the United States government and former vice-president in charge of operations for Columbia Gas & Electric Co. and its subsidiaries.

Mr. Weymouth was lent to the Alberta government board last February by the United States government. During the spring of 1943 he conducted a detailed study of Turner Valley, assisted by engineers of the companies primarily engaged in gas production, natural gasoline, and gas distribution. His final 40-page report boiled down, it made these estimates:

(1) That Turner Valley gas producers, processors and marketers, through adoption of his program, would obtain a 20 million dollar cash return in exchange for a capital equipment outlay of less than 1 million dollars, and a further operation cost outlay spread over some 20 years of a little more than 2½ million dollars.

(2) That by returning excess over market requirements to ground storage, the estimated gas reserve of Turner Valley would be extended to 31.2 years from 18.7; that the total beneficial gas recovery would be increased 159.1 billions of cu. ft. (from 223.1 billions to 382.2 billions).

That the Alberta government is ready to implement all or part of the Weymouth report was indicated in a statement made in November by Premier E. C. Manning that legislation based on the report would be introduced at the session of the legislature in February. Final reading on a bill aimed at making public utilities of pipelines, scrubbing plants, and wells producing or capable of producing gas was given before the legislature on March 20.

■ ■

Hugoton Development

Plans for the development of the Hugoton gas field are in discussion by the Oklahoma and Kansas corporation commissions. Ray Weems, vice-chairman of the Oklahoma commission, said the major question has to do with enabling the two commissions to issue special orders communitizing leases in the field on an acreage basis so that 640-acre tracts will not be subject to orders from the different commissions.

Issued by the Department of Lands and Mines, Province of Alberta

KEY TO MAP

1. **Turner Valley.** Producing oil and gas field.
2. **Red Coulee.** Producing oil field; light crude.
3. **Skiff.** Heavy crude oil. Not producing.
4. **Foremost.** Gas field-reserve.
5. **Barnwell.** Small gas field.
6. **Bow Island.** Gas field being repressured from Turner Valley.
7. **Medicine Hat.** Gas field supplies city.
8. **Brooks.** Small gas field supplies town.
9. **Oyen.** Showings of heavy oil. Not developed.
10. **Viking.** Gas field supplies Edmonton.
11. **Kinsella.** Proven gas field not yet in use.
12. **Fabyan.** Two wells supply Wainwright with gas.
13. **Wainwright.** Producing oil field. Heavy crude.
14. **Dina.** One producing oil well and others drilling.
15. **Lloydminster.** Gas produced on Saskatchewan side of boundary used in town.
16. **Duvernay.** Gas discovery may prove a field.
17. **Athabaska.** Heavy oil discovered but not developed.
18. **Smith.** Gas discoverd but not developed.
19. **Pelican.** Gas discovered.
20. **McMurray.** Vast deposit of tar sands.
21. **Peace River.** Heavy oil, not developed. Also little gas.
22. **Pouce Coupe.** Gas discovered.

DROWNING AND REVIVING GAS WELLS

Part I
Revival After Water Drowning

By S. T. YUSTER
and
H. J. SONNEY*

THE revival of intentionally or accidentally drowned gas wells is a problem which has confronted gas producers for as long as the industry has existed. The water which may have come from leaky casing, from other horizons, or from actual injection at the surface for the purpose of controlling a wild well, may build up a head in excess of the formation pressure and penetrate the producing strata. A somewhat similar effect is produced when water comes into a gas well and reduces the flow from it. In repressuring projects or in the secondary recovery of petroleum by air and gas drive methods, the entrance of water into the productive horizon at the input wells is very harmful.

In all the examples cited above, the effect of the water is to retard the flow of gas from or into the formation. In some cases the action may be so drastic as to close off flow completely. This effect in the case of a gas producing well, is not due to a head of water which neutralizes either partially or completely the formation pressure since pumping the water off the well does not bring it back to its former productivity. Probably the most logical and satisfactory explanation of the phenomenon is that it is due to Jamin action.

Nature of Plugging Action

In order to check this explanation, an artificial consolidated sand in the form of a slide (made of sintered grains of Pyrex glass) was drowned with water and the action observed under the microscope. An aspirator bulb was used to force the fluids through the sand. No difficulty was encountered when air alone was flowing through the sand. It was then drowned with water and only a slightly greater pressure was required for flow than with the air. While the sand was still filled with water, air was introduced at the inlet end of the slide and had only penetrated a short distance when the pressure required for further movement had increased to such an extent that it was almost impossible to force in more air with the hand aspirator.

Observation through the microscope showed the air bubbles occupying some of the pores; when pressure was applied, these bubbles attempted to pass through the constrictions between the sand grains. In so doing, it was necessary to distort the bubble considerably. This distortion requires considerable force and, if the breakdown pressure is not exceeded, the bubbles remain in place and hamper the movement of fluids through the sand. In other words, the conducting medium is no longer simply an assemblage of sand grains but must be considered as a complex of solid grains and relatively stationary gas bubbles and water.

This phenomenon was first discovered by Jamin, a French physicist, in 1860 and it is known as Jamin action. From the picture given above there is little difficulty in understanding why the effective permeability of the sand has been reduced, since some of the channels are blocked to flow. That this blocking is actually performed by fluids seems fantastic at first thought. However, the experiments just described seem to give adequate support to the belief that the drowning results in a Jamin action which reduces conductivity.

From mathematical and physic-chemical considerations, it can be seen that the methods of attack on the problem fall into the following subdivisions:

1. Removal of water from the vicinity of the well bore by increasing the pressure differential between the well bore and the formation to overcome the Jamin action and force the water ring far into the sand where its thickness and effectiveness in plugging will be greatly reduced.
2. Reducing the surface tension of the water in the sand and thereby decreasing the pressure necessary to move the water.
3. Dilution of the water in the sand with water-miscible, high vapor pressure solvents resulting in a more volatile fluid mixture which may be removed by evaporation.
4. Combination of the above methods.

With the above possibilities in mind, a series of experiments was made in the laboratory to test their practicability.

Apparatus

The apparatus was essentially a system whereby gases and liquids could be made to flow radially through a cylinder of sandstone under various pressures. The experimental setup is shown in Figs. 1 and 2. Nitrogen gas was used in the tests since it is inert, convenient, and safe. A high pressure regulator reduced the tank pressure to approximately 15 lbs. gauge, and a second regulator further reduced it to the pressure selected for the test. The pressure was measured by a mercury manometer. From the low pressure regulator the gas was admitted to the core holder through a needle valve and passed radially through the core from the outside towards the center. A graduate connected to the outlet of the core holder through a fluid sealed trap served to

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This investigation was performed in the Petroleum Production Research Laboratories of the School of Mineral Industries, The Pennsylvania State College.

NEW METHODS for the reviving of drowned natural gas wells and mitigating the detrimental effect of water in intentionally killed wells have been developed through a cooperative program of research over a three-year period by United Natural Gas Co., Oil City, Pa. and the School of Mineral Industries of the Pennsylvania State College.

Following laboratory experiments by a United Natural Gas Co. research employee in conjunction with research workers at the Petroleum Production Research Laboratories of The Pennsylvania State College, in which many chemicals and solvents were tried on sand cores, field experiments were conducted in killing and unplugging of three wells of United Natural.

The results of these tests are very encouraging. One relatively large well was killed and revived many times by the use of different reagents and another low volume well, which had been accidentally drowned out, was revived.

GAS presents, herewith, abstracts of three papers based on this research program: PART 1, "The Revival After Water Drowning," and PART 2, "The Safe Drowning of Gas Wells"; both are by S. T. YUSTER and K. J. SONNEY, and describe laboratory experiments. PART 3, "Treatment of Gas Sands to Prevent or Overcome the Detrimental Effect of Water," by K. J. SONNEY and CHARLES E. WILLIAMS, deals with full scale field tests.

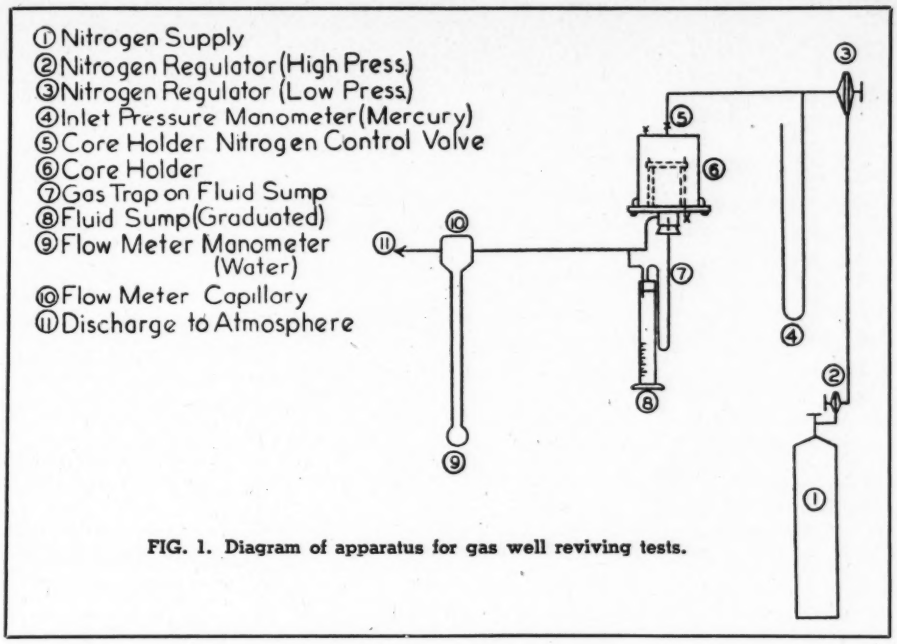


FIG. 1. Diagram of apparatus for gas well reviving tests.

measure liquid which came through or from within the core. The graduate and the outlet end of the core holder were connected through a T-tube to a capillary flowmeter which measured the rate of flow of gas coming from the core. The flow meter was provided with several calibrated capillaries which permitted a considerable range of flow rates to be very accurately measured. The entire apparatus was in a constant temperature chamber maintained at 20° C.

Four diamond drilled cores from the Bradford sand were used in the experiments. They had previously been extracted with butanol to remove the oil and water, placed in an electric oven at 1050° C. for 15 hours, and finally cooled in a desiccator.

Experimental Procedure

The general procedure in making the unplugging tests was to place a previously weighed core in the core holder, and with the core in place but without any gas flowing, distilled water was run into the holder through a hose connected to the water filling cock.

After a coreholder was filled with water, the valves were closed, and nitrogen under pressure was admitted to the pressure pot, thus forcing water through the core. Water was passed through the core until the rate of flow became constant as determined by readings of the quantity of liquid collected in the graduate at five minute intervals. When the core had been flooded, it was removed, weighed, and then replaced in the coreholder from which the water had been removed. The gain in weight of the core represents the amount of water which it took up during the drowning process. Gas was then passed through the core until the rate of gas flow became fairly constant. The core was again removed from the holder and weighed. The difference between this weight and the dry weight gives the amount of water in the sand prior to treatment with an unplugging compound.

For the unplugging treatment, the core was clamped into the coreholder, but was not inserted into the pressure pot. The coreholder was inverted and connected to a burette as shown in Fig. 3. With this arrangement of the apparatus, the various chemicals could be injected at any desired pressure from the center of the core radially outward as would be necessary in applying them in the field. When an injection was made, the operation was carried on until there was evidence of the liquid coming out of the core as determined by the first appearance of liquid on the outside of the core. As soon as the injection was completed, the core was removed from the holder, re-weighed, quickly replaced into the coreholder and inserted into the pressure pot. Gas was then passed through the core and the effects of the injection noted.

In order to investigate the general nature of the action of volatile, water-miscible liquids on the Jamin plug, the following were used in a series of experiments: ethyl alcohol, methyl alcohol, acetone, 9:1 acetone-ethyl ether mixture, and crude methanol. These substances have a fair range of vapor pressures and should evaluate the effect of this factor on unplugging. A 1% solution of Igepon T (a wetting agent manufactured by the General Dyestuffs Corp.) was also used in order to study the effect of the lowering of surface tension as separate from vapor pressure increase.

Typical data are summarized in Fig. 3. It can be seen that the lowering of the surface tension has only had a slight effect on the Jamin plug. The alcohol however, has a very beneficial effect and it appears, therefore, that the predominating factor is the raising of the vapor pressure rather than the lowering of the surface tension since both substances lower surface tension while only alcohol raises the vapor pressure.

Since an increase in vapor pressure seems to be a necessity for a good unplugging action, the effect of this factor was studied by treating a core with ethyl alcohol, methyl alcohol, acetone, and an acetone-ether mixture containing 10% ethyl ether. The vapor pressures of these liquids in cm. of Hg at 20° C. are respectively 4.5, 8.9, 18.0 and 20.5. The latter value was estimated from Raoult's law. The vapor pressure of water at the same temperature is 1.74 cm. Hg.

Fig. 4 gives a summary of typical data. The rate of the unplugging action seems to vary as some direct function of the vapor pressures of the

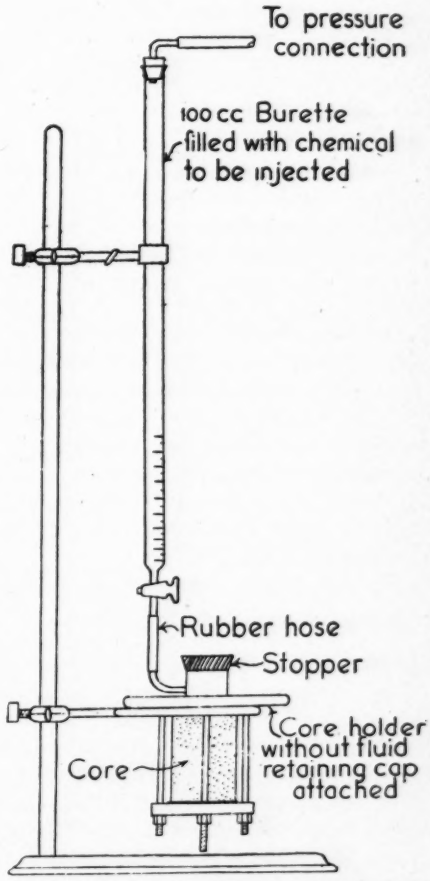


FIG. 2. Method of chemical injection into core.

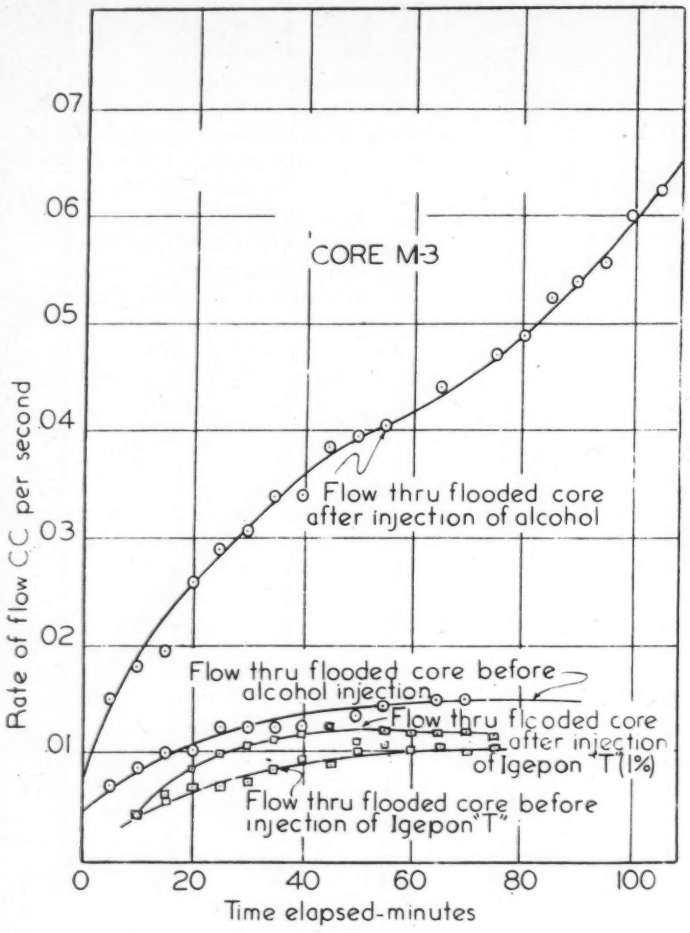

CORE M-3
Flow thru flooded core after injection of alcohol
Flow thru flooded core before alcohol injection
Flow thru flooded core after injection of Igepon "T" (1%)
Flow thru flooded core before injection of Igepon "T"
Rate of flow CC per second
Time elapsed-minutes

FIG. 3. Determination of predominating action.

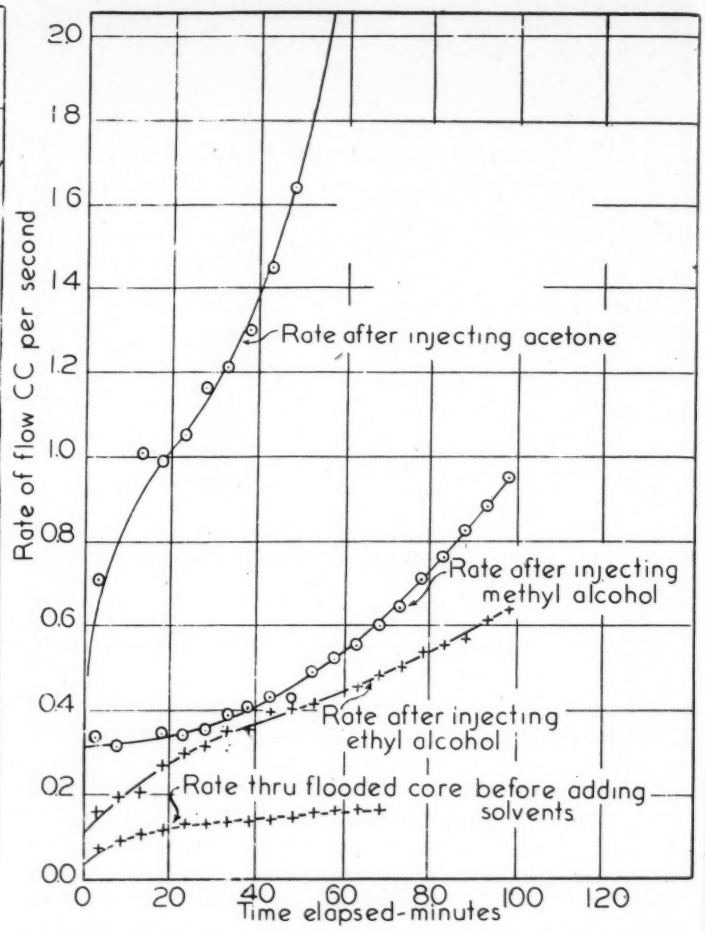

Rate after injecting acetone
Rate after injecting methyl alcohol
Rate after injecting ethyl alcohol
Rate thru flooded core before adding solvents
Rate of flow CC per second
Time elapsed-minutes

FIG. 4. Comparison of the effect of various agents on unplugging action.

treating liquid. The acetone and acetone-ether treatments are especially gratifying.

Additional testing indicated that for tighter sands, especially where the pressure gradient is low, it may be necessary to give more than one injection of treating liquid, whereas, with higher permeabilities or greater pressure gradients one injection may be sufficient; also that the moisture free gas is more effective in removing the Jamin plug than the moist gas, which is to be expected since the unplugging process requires a removal of water and a moisture-free gas will take on more water than one already containing water vapor.

It also appears that as far as the general action is concerned, acetone unplugs a brine flooded core as effectively as it does a water flooded core; however, since the process is chiefly one of evaporation, it is reasonable to expect that whatever salts are in solution in the drowning water will remain as a deposit in the sand after evaporation of the water. Therefore, some decrease in permeability should take place.

Nitrogen was used in all these experiments for the sake of convenience and safety. However, the gas which is actually involved in the problem is natural gas. In order to determine the difference in behavior between the two gases, some tests were run, and it appears that not only does natural gas show a more rapid response to treatment but, in addition, the Jamin action is not as intense in the drowned sand. No explanation has been found for this difference but it may be due to the higher solubility of methane in water than nitrogen and the lowering of the surface tension of water.

Conclusion

It is concluded that the ideal treating fluid is one which forms a high vapor pressure and low surface tension mixture with water and one which is low in cost. It is believed that substances which satisfy these conditions will be effective.

From an economic standpoint acetone appears to be the most satisfactory liquid with the possibility of adding 10% ethyl ether to it for further improvement.

Part II
The Safe Drowning of Gas Wells

IN some cases it may be necessary to drown a gas well, but it is desirable to do so under controlled conditions which will enable the operator to bring it back to normal production at will. This is advantageous in bringing a wild well under control or when special treatment is necessary on an already completed well. One of the first thoughts for doing this would naturally be the use of a mixture of water and one of the liquids (such as acetone) mentioned in Part 1, of this paper. Although such a mixture is infinitely better than water alone, there are still better ones available. The vapor pressure of these mixtures is limited by the vapor pressure of the liquid which is added to the water.

Since there is usually no water in the producing sand of a well which it is desired to "kill," the drowning liquid need not be miscible with water in all proportions. About the only condition necessary is that it have

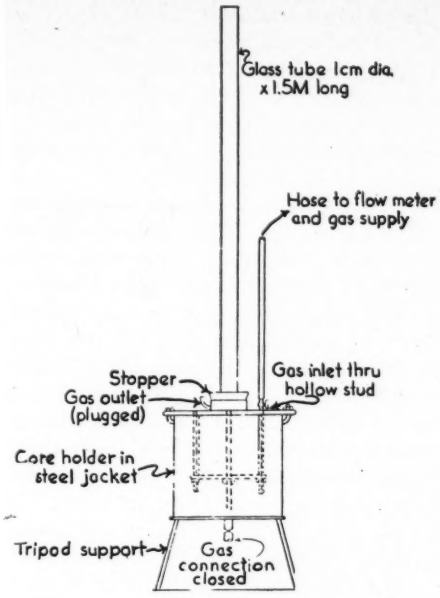

Glass tube 1cm dia. x 1.5M long
Hose to flow meter and gas supply
Stopper
Gas outlet (plugged)
Gas inlet thru hollow stud
Core holder in steel jacket
Tripod support
Gas connection closed

FIG. 5. Arrangement of apparatus for drowning tests.

a higher vapor pressure. Natural gasoline is such a liquid which is low in price.

The principle of killing a well is dependent upon applying a column of liquid in the well which exerts a pressure that is at least equal to the formation pressure. Natural gasoline might be used for the purpose under certain limited conditions where the formation pressure is relatively low.

If the bottom hole pressure in the well is greater than the head of gasoline in it, it will not be possible to kill the well with this liquid. If a volatile liquid having a density equal to, or greater than, that of water could be used, it would be highly advantageous. Examples of liquids of this type are the chlorinated hydrocarbons such as carbon tetrachloride (sp. gr. 1.595), or mixtures of hydrocarbons such as natural gasoline and carbon tetrachloride in the proper proportions. Such mixtures can be adjusted to any density within the range of the components.

Although the mixture alone can be used for killing a well, it may be too expensive to fill the well bore with it. If some sort of packer arrangement with very small tubing to the surface could be set in the well, the head of liquid could be obtained without excessive quantities of liquid being necessary. It is possible, however, to use a relatively small quantity of the volatile, water-immiscible liquid along with a large quantity of water. If the volatile liquid mixture is adjusted to a density greater than that of water, it may be poured or lubricated into the well in such quantities as to wet the sand and extend up into the well for some convenient distance. If water is poured into the well after it, the water, being the lightest of the two liquids, will float on the volatile liquid. Sufficient water is then added to kill the well.

There will be some tendency for the volatile liquid to penetrate the formation and if the proper precautions are not taken, the water will finally enter the sand, a condition which must be avoided. In order to eliminate this danger, more volatile treating liquid might be poured on top of the water and being heavier than it, will go to the bottom of the well and prevent the water-hydrocarbon liquid interface from touching the sand. The rate of adding this liquid should be determined by the rate at which the well takes liquid during the shutdown and the rate at which the added hydrocarbon liquid falls through the water column. If the rate of fall is too slow, the fluid could be injected into the bottom of the well through macaroni tubing. After the conditioning of the well has been completed, the water can be removed and the volatile liquid will be evaported by the gas in the formation.

Apparatus and Experimental Method

The apparatus shown schematically in Fig. 5 was used to test the possibilities of the theory just discussed. A core held in the usual coreholder was placed in the pressure pot which rested on a tripod. A long glass tube was inserted into a stopper and placed into the outlet end of the coreholder. This acted as well tubing. Dry compressed air was used as the gas and injected into the pressure pot so that it flowed radially through the core and out the well tubing. Liquids were poured into the glass tubing until the flow of gas ceased, and as the level decreased due to penetration in the sand, sufficient liquid was added to maintain a safe head in order to prevent blowouts.

After the laboratory "well" had been dead for some time, the head was lowered by removing some of the liquid, thereby permitting gas flow from the well to be resumed. Observations were then made to determine if the original rate of production could be regained. In every case the return to normal production was extremely rapid and no difficulty whatsoever was encountered in removing all of the treating liquid. The well could be kept killed for any desired length of time.

In the experiments in which water was used with hydrocarbon liquids, the treating liquid was poured into the tube until a sufficient quantity had been injected to keep the sand face covered with it. Water was then poured in until all gas flow had ceased. As the fluid level declined, a carbon tetrachloride-natural gasoline mixture was added in sufficient quantities to maintain the liquid level up to the point where no gas flowed from the sand. It was not possible to carry out any extended experiments on this particular phase of the work due to the small size of equipment.

From the results of these experiments, it would seem that it should be possible under specialized conditions to kill a well by the methods just discussed. With extremely high pressures in a wild well, it is doubtful if these methods could be adapted.

ACKNOWLEDGMENTS

The authors wish to thank Mr. J. G. Montgomery, Vice President of the United Natural Gas Company, and Dr. A. W. Gauger, Director of Mineral Industries Research, at The Pennsylvania State College, for their suggestions and criticisms during this work. Acknowledgments are also due to the members of the Petroleum Production Research staff at the Pennsylvania State College with whom this problem has been discussed on numerous occasions.

Part III

Treatment of Gas Sands to Prevent Detrimental Effect of Water

By H. J. SONNEY*
and
CHAS. E. WILLIAMS*

SOME past experiences showing that the existence of this water flooding problem has long been recognized by Natural Gas Well operators are indicated by the data in Table 1.

Geologists and engineers of United Natural Gas Co. were aware of the fundamental action responsible for this decrease in productive capacity, but the definite course of action described in the previous papers was not undertaken until well "H" (Table 1) whose initial open flow was gauged at 26,938,000 cu. ft. per day was reduced to 15,475,000 cu. ft. per day after flooding with water.

In order to test the laboratory findings in the field, several tests were undertaken. Descriptions of tests and results obtained on three wells follow.

*United Natural Gas Co., Oil City, Pa.

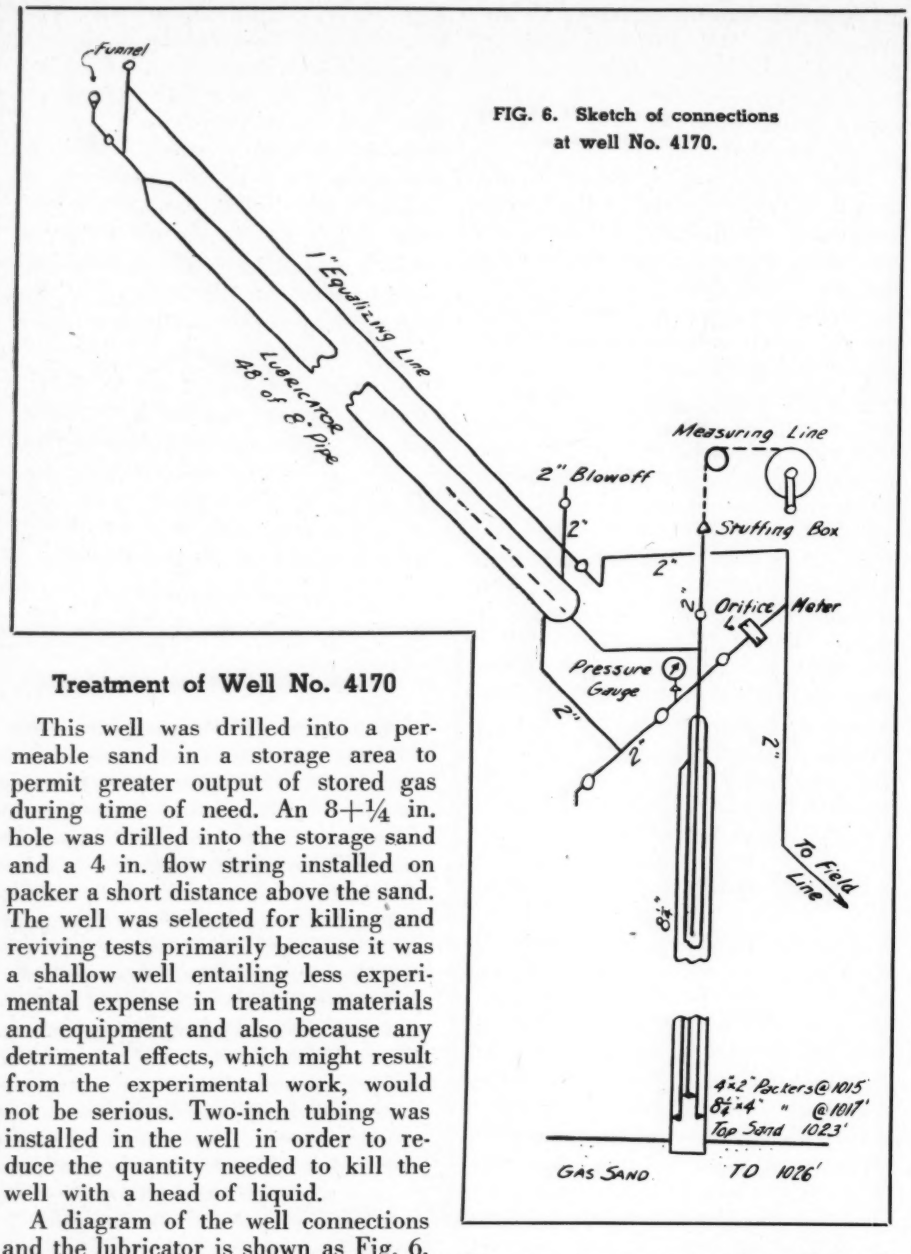


FIG. 6. Sketch of connections at well No. 4170.

Treatment of Well No. 4170

This well was drilled into a permeable sand in a storage area to permit greater output of stored gas during time of need. An 8+¼ in. hole was drilled into the storage sand and a 4 in. flow string installed on packer a short distance above the sand. The well was selected for killing and reviving tests primarily because it was a shallow well entailing less experimental expense in treating materials and equipment and also because any detrimental effects, which might result from the experimental work, would not be serious. Two-inch tubing was installed in the well in order to reduce the quantity needed to kill the well with a head of liquid.

A diagram of the well connections and the lubricator is shown as Fig. 6. A lubricator was necessary since the well had a flow of approximately 1,060,000 cu. ft. per day through 2 in. tubing with a closed-in pressure of 223 lbs. gauge, making it impossible to inject liquid into the well without the aid of equipment such as a pump or lubricator. The lubricator was arranged with "swings" at the well head which permitted the free end to be raised or lowered for filling and emptying, and permitted the liquids to be collected and saved for future use.

The general procedure was to fill the lubricator with the liquid to be injected while the lubricator sloped downward toward the well. With the well closed in, the valve from the lubricator was opened and the liquid permitted to flow by gravity into the tubing. When sufficient liquid had been injected into the well to "kill" it, the pressure gauge on the well head read zero. The liquid level in the well was determined by means of a wooden float attached to a measuring line lowered into the well through a stuffing box.

In removing the liquid, the well was bailed or swabbed until flowing started. The flow stream was then turned into the lubricator, free end lowered, and the liquid trapped off, using the lubricator as a trap. Gas flow was permitted to escape from the 2 in. blow-off at the well end of the lubricator. After each treatment, the well produced into the line until the rate of gas flow, as determined from daily open flow and delivery tests, indicated that a settled condition existed.

The well was first "killed" with drip gasoline and remained completely dead for six hours, after which the flow came back to 1,000,000 cu. ft., or to 94.3% of the open flow before killing. Inasmuch as old tubing was used in this well, it is possible that some of the decrease in flow may have been due to dirt and rust obstructing the pores of the sand.

It was found necessary to ream the tubing in order to permit a swab to be used and the well was again "killed" with gasoline while reaming. It was dead and open to atmosphere for 55 minutes during which reaming was done. After this second "killing" the well came back to 988,000 cu. ft., or to 98.8% of the open flow before the second "killing." These two tests seem to indicate that there was no appreciable harm resulting from the use of gasoline in "killing" this well. These results bear out the laboratory tests.

The well was then "killed" with a commercial grade of acetone, and came back to an open flow of 825,000 cu. ft. per day, or to 83.5% of the open flow before the third "killing." This would seem to indicate that there was some slight plugging effect produced by the acetone.

Unplugging Tests

After testing for the effect of acetone, the well was "killed" with fresh water from a spring and came back upon revival with an open flow of 563,000 cu. ft. per day which was only 68.3% of the open flow immediately before injecting water. A single injection of acetone brought the well back to an open flow of 815,000 cu. ft. per day or 98.8% of the open flow before "killing" with water. A second injection of acetone did not improve the open flow of the well but gave a decrease in flow of 9.5% or to 738,000 cu. ft. per day.

Fresh acetone was not used on each successive treatment of the well and, although some precautions were taken against injecting contaminated acetone, it was noticed that considerable dirt accompanied the acetone removed from the well. Perhaps the contaminated acetone may account for the apparent ineffectiveness or relative inefficiency of some of the treatments.

The well was again "killed" with water and upon revival came back with an open flow of 529,000 cu. ft. per day. A single injection of acetone, which remained on the sand over-night, brought the flow up to 658,000 cu. ft. per day. A second injection of acetone, which was loaded and followed into the sand with gas from a higher pressure well, increased the open flow to 725,000 cu. ft. per day. This was within 2% of the open flow of the well immediately before "killing" with

water the second time. The treatments with acetone indicate that results in the field are in accord with those obtained in the laboratory; further, added benefit may be obtained by following the acetone into the sand with gas.

It will be observed that the open flow at the end of the tests was 745,000 cu. ft. per day, which is a net decrease of 29.7% from the open flow before the tests were started. Some of this decrease in flow is due to the decline in shut-in pressure of the well. After correcting for decline in shut-in pressure, the open flow at the end of the tests would be approximately 972,000 cu. ft. per day which is a net decrease of 72.7% from the theoretical open flow.

Treatment of Well No. 2863

This had been flooded by a great head of fresh water and was completely drowned out. The water had been in contact with the producing sand for about one month. Under normal operations the well produced an extremely small volume of gas, from a tight sand, and in an area where the formation pressure was only about 80 lbs. gauge.

After repairs had been made to the tubing, the open flow was only 500 cu. ft. per day. It was selected for treatment because of the experimental results to be expected rather than the economical benefits to the low volume well. Due to the pressure and permeability of the producing sand, a different procedure was required at this well although the principle of following the acetone into the sand with gas, which was beneficial at well No. 4170, was considered advisable to follow.

A simple calculation can be made to show the action which should take place in such a process. If it be assumed that the water which damaged the well penetrates the sand evenly in all directions, it will spread in a ring whose center is the well. When gas is injected, it will push the water back into the sand and the ring will diminish in thickness (See Fig. 7) to the equation:

$$T = \sqrt{p^2 - r_w^2 + d^2} - d$$

In which

T=Thickness in feet of the water barrier at any point.

P=The distance into the sand the water had originally penetrated, measured in feet from the well center.

rw=The radius of the well bore in feet.

d=Distance in feet from the center of the well to the inside edge of the water barrier.

If the ring is pushed out far enough, it will eventually break leaving channels cleared for gas passage. Further, it can be shown that if high pressure relatively dry gas is forced into the well, it will pick up fluid vapors in expanding from the injection pressure to the formation pressure; and, also, in expanding from the formation pressure to the lower well pressure when the flow is reversed and the well is placed on production. If the water in the sand were previously diluted with acetone, it would seem that the maximum benefit could thus be obtained.

Connections were made to high pressure gas lines in the field and, after placing 244 gals. of acetone above the sand, an attempt was made to force the acetone into the sand and follow it with gas. Although the acetone was forced into the sand, it was not possible, with the pressure available, to obtain sufficient penetration to break down the water barrier. A portable gas compressor, capable of pumping against 500 lbs. pressure, was then installed in the system and several injections of gas were made.

Results from this test show that the barrier was finally broken and that the well is evidently in communication with the rest of the field. The flow has been increased from 500 cu. ft. per day to 2400 cu. ft. per day. The flow, previous to flooding when computed from the 15-minute rise above line pressure, was 3500 cu. ft. per day. The calculations of the distance the water ring moved indicates that the ring, if maintained in circular shape, broke through at a distance of 37.8 ft. from the well.

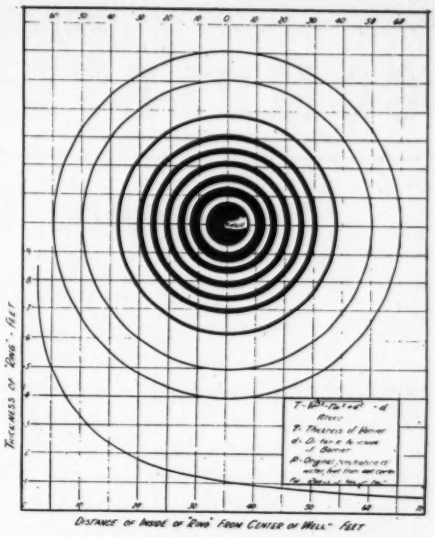


FIG. 7. Hypothetical thickness assumed by water barrier at various distances from gas well. Scale ½ in. = 10 ft.

The original work was done in April 1940. Tests made in June 1941 and August 1943 show the well to be about the same as it was previous to treatment, and it has been producing gas into the line continuously since it was treated except for a short period to permit taking pressures.

Filling Flow of Well No. 3507

In addition to tests on the two wells as explained above, it has been necessary, in order to repair, to "kill" a well (No. 3507) having an open flow of 380,000 cu. ft. per day and a rock pressure of 655 lbs. gauge. Enough acetone was lubricated into the well to cover the producing sands so that the uppermost sand was covered to a depth of 20 ft.; the remainder of the hole was then filled with water to a point sufficient to balance the formation pressure. The well was then bridged below the pipe depth but above the producing sands, and was completely dead for a period of seven days during which time casing repairs were made. After the casing was repaired, the tubing was fished out and the bridge removed. Between the seventh and fourteenth days, the well started gassing slightly but no fluid was added to stop the gas flow. After the well was cleaned out, the fluid removed, and the well put back on production, the open flow was gauged at 346,000 cu. ft. per day, a decrease of only 9% from the flow before killing. This compares with decreases in flow as great as 59% when other wells have been killed with water alone.

Table 1

Volume in C.F. per Day

Well	*Date Flooded*	*Before Flooded*	*After Flooded*	*Remarks*
A	June 1933	5,000	1,100	Vol. 1,697 after shooting
B	Jan. 1928	6,000	3,500	Drilled deeper
C	Jan. 1937	1,600	000	Abandoned
D	July 1929	16,000	387	Abandoned
E	Apr. 1935	26,000	245	
F	Oct. 1934	50,000	2,700	Shot
G	1924	24,789	2,400	
H	Apr. 1939	26,938,000	15,475,000	

Panhandle Eastern Pipe Line Company

COMPLETES WARTIME EXPANSION

Pipeline Construction

By J. W. HALL

Engineer in charge of Pipeline Construction

PANHANDLE Eastern Pipe Line Co., aware that the increasing tempo of war production would place greater demands on its system in 1943 decided to expand its facilities in 1943. Despite the difficulties of inclement weather encountered and in procuring material, equipment and labor, the work was completed by Feb. 29.

The system, comprised of field gathering lines in Kansas and Texas, a main transmission line extending from Texas Panhandle to Detroit, with lateral lines to intermediate points in Kansas, Missouri, Illinois, Indiana, Ohio and Michigan serves a large area devoted to war production.

The original studies indicated that a 22-in. loop line would be required out of Hansford compressor station, but by a nice balance of sizes and lengths it was found that the required capacity could be obtained by replacing 36 miles of the 22-in. main line between Hansford and Liberal stations with 20-in. pipe. The 22-in. pipe reclaimed from this section was then used to lay loop lines out of Sneed compressor station. Under this plan 2700 tons of steel were saved for use elsewhere in the war effort.

The program adopted called for construction of eight loops on the main line, totaling:

34.03 Miles of 22 in. Line
86.8 Miles of 24 in. Line
121.88 Miles of 26 in. Line (Including 1 mile across Beaver River)
Reclaim 35.15 Miles of 22 in. Line
Additional compressor installation totaling 24,600 hp.

Location of lines and compressor installations are shown on the system map, however. This article deals only with construction of loop pipe lines shown in dashed lines.

For purposes of awarding contracts, the work was divided into two sections: Western section—including all lines in Kansas, Oklahoma, and Texas—was awarded to Bechtel-Demsey-Price of Tulsa, Okla. Eastern section—including all lines in Indiana and Ohio—was awarded to Stanley-Bledsoe Construction Co. of Tulsa, Okla.

Construction schedules called for one crew to start on Olpe Loop, one crew on Liberal Loop, one crew on Beaver River, one crew on Zionsville Loop; with an optional additional crew on Edgerton Loop. After some delay first pipe was received on Olpe Loop July 19, on Liberal Loop July 25, on Beaver River, Aug. 25 and on Zionsville Loop Aug. 1. Thereafter pipe was received in quantities up to 5 miles per day, until deliveries of all pipe had been completed. As work went forward, Stanley-Bledsoe decided to place an additional crew on the Edgerton Loop and the construction of this loop was started Sept. 12.

Favorable weather held through the summer and fall and construction was completed and lines placed in service as follows:

	Miles	*Diameter Inches*	*Date*
Liberal Loop	23.37	26	Sept. 26
Beaver River	1.00	24	Sept. 25
Hansford Main Line	35.15	26	Nov. 7
Edgerton Loop	18.25	24	Nov. 11
Olpe Loop	26.64	26	Nov. 13
Zionsville Loop	68.56	24	Nov. 17
Greensburg Loop	20.19	26	Nov. 18
Haven Loop	15.53	26	Dec. 12
Sneed Loop and Suction	34.03	22	Feb. 29

The favorable weather which had held through the summer and fall was ended in the Panhandle area on Dec. 8 by a severe blizzard, followed by a second blizzard on Dec. 27 and a third on Jan. 7. With the Sneed Loop and a portion of the Hansford 22-in. reclaim work incomplete, difficulties multiplied and many construction problems arose. The company decided, however, to continue work on these lines so that the additional facilities would be available at the earliest possible moment.

Design of the lines followed conventional forms, continuing the trend to lighter wall thickness for large diameter pipe. Principal specifications were as follows:

Sneed Loop

Pipe: 22 in. O.D. x 5/16 in. W. T. Average length of joints 30 ft. Reclaimed from Hansford main line.

Joints: Alternate welded and coupled, with Dresser Style 38 coupling every 60 ft.

Coating: Coal tar plasticized enamel used for both pipe and couplings.

Hansford Main Line

Pipe: 26 in. O.D. x ¼ in W. T. A. O. Smith electric welded plain end pipe, 40-ft lengths.

Joints: All welded—electric arc.

Coating: Coal tar plasticized enamel with one bonded wrapping of kraft paper.

Liberal - Greensburg - Haven and Olpe Loops

Pipe: 26 in. O.D. x 9/32 in. W. T. A. O. Smith electric welded plain end pipe, 40-ft. lengths.

Joints: Alternate welded and coupled. Electric arc Weld-Dresser Style 36 coupling.

Coating: Coal tar plasticized enamel with one bonded wrapping of kraft paper. Used for both pipe and couplings.

Zionville and Edgerton Loops

Pipe: 24 in. O.D. x 9/32 in. W. T. A. O. Smith electric welded plain end pipe, 40-ft. lengths.

Joints: All welded—electric arc.

Coating: Coal tar plasticized enamel with one bonded wrapping of kraft paper.

Beaver River Crossing

Pipe: 24 in. O.D. x 9/32 in. W. T. A. O. Smith electric welded plain end pipe, 40-ft. lengths.

Joints: All welded—electric arc, with ½ in. steel welding sleeves.

Coating: Coal tar plasticized enamel with bonded wrapping of kraft.

Special: Pipe laid a minimum depth of 14 ft. below river bed with cast iron river clamps every 40 ft.

Orthodox construction methods were used on most of the work. On the eastern section the contractor used the head-welding procedure for laying the Zionsville loop, but found the stove-pipe method better adapted for the shorter Edgerton loop. Most of the bending on the Zionsville loop was done by the fire-bend method, but on the Edgerton loop a C-R-C machine for cold bending was used with considerable success. Pipe was clean-

ed and coated with line-traveling type machines. Bending was done ahead of painting operations.

A high rate of progress was maintained by the contractor on the Zionsville-Edgerton loops by having a special gang install road, creek and river crossing and valve settings ahead of the main laying gang. Delay of the main gang was thus avoided.

On the western section the contractor used the head-welding method for laying of both alternate welded and coupled lines and solid welded lines. Bends in the 26 in. pipe were made by wrinkle-bending. This is a departure from standard practice for this company, and was decided upon as a means of avoiding waste of pipe from buckling (a fairly common occurrence with other methods of bending), as well as offering a more flexible control of bends.

On the Sneed 22 in. loop where reclaimed lap-weld pipe was being used, it was found that wrinkles placed across the lap-weld seam would cause the seam to open: wrinkles opposite the seam had no effect. Wherever possible, reclaimed bends were used in relaying the pipe.

Pipe was cleaned and coated by line-traveling type machines, couplings being coated by hand, except that on the Sneed 22-in. line, a line-traveling type machine designed to paint the couplings was used. Coal tar plasticized enamel was used for both pipe and coupling coating, whether couplings were coated by machine or by hand.

The section of 22 in. pipe reclaimed had been in service since 1930, and was constructed of 20-ft. random lengths of lap-weld pipe, acetylene welded joints with a coupling every 60 ft. The line was stripped with ditching machine to within 4 in. of top of pipe and then raised to top of ditch and placed on skids. Coupling bolts were cut with acetylene torch and the entire couplings junked. Inspection of the pipe revealed very little corrosion, but the original coating showed sufficient deterioration to warrant recoating. The acetylene welds were inspected individually, and those showing defects were cut out at time pipe was lifted; the cuts thus made were left to be rewelded at time pipe was relaid. Those welds passing inspection were allowed to remain in the line. Pipe was hauled by truck, and strung on Sneed loop and cleaned by line-traveling type machine, in the same sequence of operations as for new pipe.

The 22 in. pipe reclaim included a multiple line crossing of the Beaver River. At the point of the crossing, the Beaver is a river typical of the Texas Panhandle area, running practically dry most of the time, but subject to sudden and destructive "head rises." Sand banks and channel bed offer practically no protection during periods of flood. Experience with this river indicated that precautions should be used to protect the installation of lines. It was finally decided to leave the original multiple crossing in the river and install an additional single 24-in. line with interconnecting lines between the two crossings.

The 24-in. pipe was buried to a minimum depth of 14 ft. below river

(1) Lowering-in creek crossing. Haven loop. (2) Squeegee for forcing aerosol solution through pipeline. (3) Zionville loop, 1943. Bending with C-R-C machine. (4) Gate valve and 12-in. inter-connection. Olpe loop.

bed. This is below the area of turbulence during floods. Well points were used to carry on excavation to this depth in the sand and as sections of approximately 400 ft. were de-watered and excavated, additional lengths of pipe were added to lengths previously installed. Each weld was reinforced by a ½ in. steel welding sleeve. Pipe was painted and wrapped and ditch backfilled. Well points were carried forward to the next section and the entire operation repeated.

Cathodic protection against corrosion of the line in the Beaver River area is provided by a windmill type generator and cathodic installation.

Upon completion of construction of individual sections, lines were blown and tested for service. In order to reduce the accumulation of dirt and other matter remaining in the line after construction, a special solution of Aerosol and water between two rubber squeegees was forced through the line by gas pressure. This solution removed any foreign matter adhering to the interior of the pipe, and as an innovation by this company offers a lead for further investigation along this line.

Compressor Plants

By F. S. YOUNG

Engineer in charge of Compressor Station Construction

IN addition to the completion of a major pipe line construction program, consisting primarily of some 200 miles of main line looping, Panhandle Eastern Pipe Line Co. has recently completed the installation of 24,600 additional compressor horsepower in its existing main line compressor stations.

Engineering studies of main line capacity requirements for peak load conditions, indicated that the economic balance of the company's system as to pipe and power, called for a compression ratio of 1.60 as a basis for compressor station horsepower design and the conclusion of the studies resulted in the installation of additions to all main line compressor stations from Texas to central Illinois. A tabulation of additions to the stations and their relative location on the system map is shown in Table 1.

Contracts for the construction of the compressor station additions were let to three engineering firms, The Fluor Corp., J. F. Pritchard & Co. and Midwestern Engineers. To expedite the completion of the jobs and also to compensate for the unknown element in labor costs during this present emergency, the contracts were let on a lump-sum fee basis plus payment of actual incurred labor costs. This fee arrangement was very satisfactory in so far as the company was concerned, especially in times of labor shortage such as was experienced during this construction.

The company's engineering department made all designs in connection with the compressor additions, and its purchasing department purchased all material for the complete installation of the new additions. Resident engineers in the field helped to expedite the actual construction of the work after having spent several months in the office familiarizing themselves with construction drawings and company policies. Very close contact between the contractor and the company was maintained at all times as the company was directly responsible for expediting delivery of material necessary to

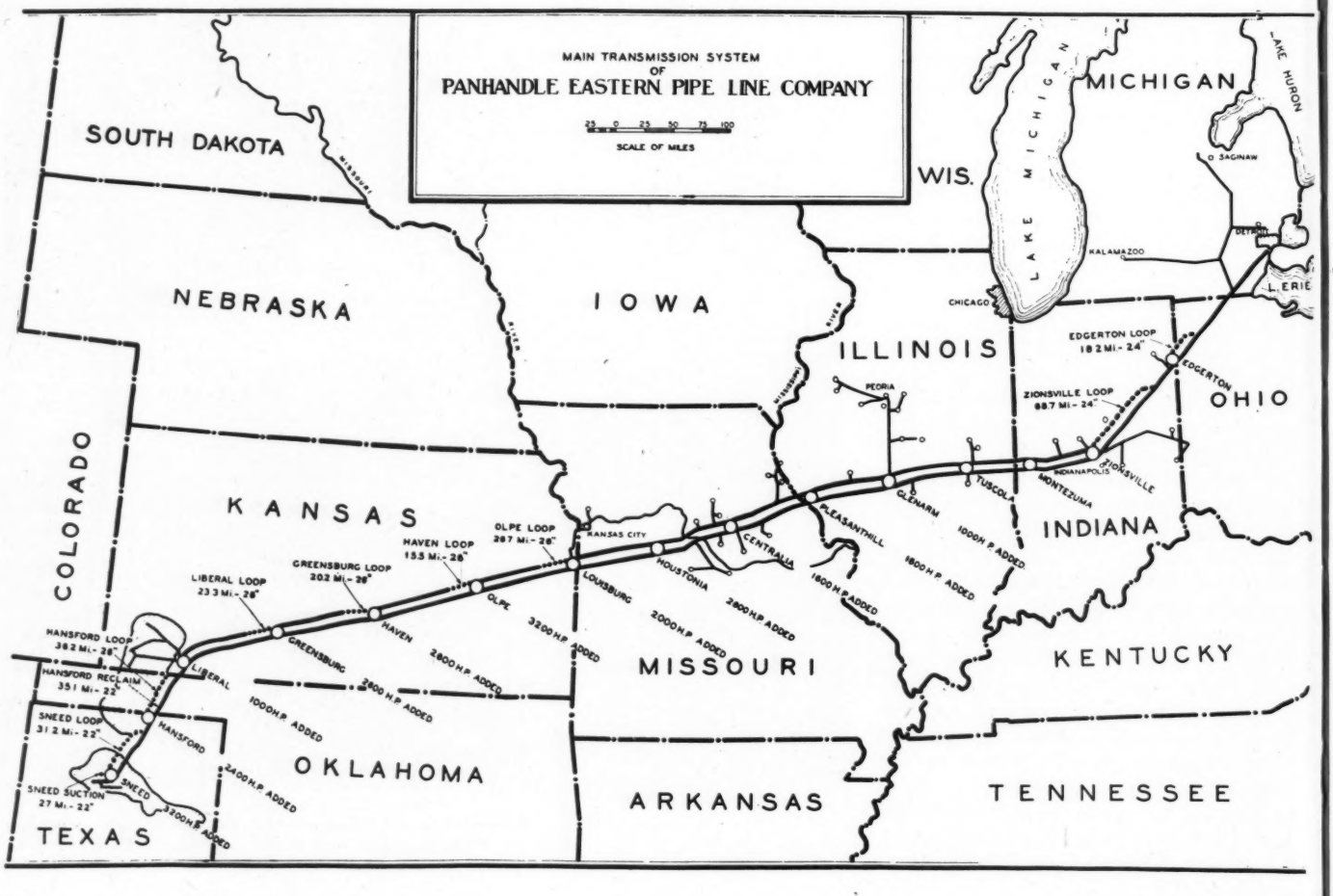


TABLE 1. ADDED HORSEPOWER AND LOCATIONS OF COMPRESSOR STATIONS

Station	*Location*	*Additional Horsepower*	*Total Horsepower*
Sneed	Stinnett, Tex.	4- 800 Ingersoll-Rand	11,000
Hansford	Hitchland, Tex.	4- 800 " "	8,400
Liberal	Liberal, Kan.	1-1000 Cooper,Bessemer	11,000
Greensburg	Greensburg, Kan.	2-1300 " "	10,400
Haven	Haven, Kan.	2-1300 " "	10,400
Olpe	Olpe, Kan.	4- 800 Ingersoll-Rand	11,000
Louisburg	Louisburg, Kan.	2-1000 Cooper-Bessemer	9,000
Houstonia	Houstonia, Mo.	2-1300 " "	9,100
Centralia	Centralia, Mo.	2- 800 Clark Bros.	9,400
Pleasant Hill	Pleasant Hill, Ill	2- 800 Clark Bros.	9,400
Glenarm	Springfield, Ill.	1-1000 Cooper-Bessemer	8,000

keep the contractor's forces busy and the various jobs moving.

The actual design of the plant additions entail some special features which are worth mentioning, such as:

1. Jacket Water Systems

Prior to 1943 the company's jacket water system for compressor and engine cooling water was of the open, hot well type, using atmospheric cooling towers for a cooling medium. Atmospheric towers have proved very satisfactory to date, especially when load factors were not as great as called for by present requirements. Since the proposed load design called for a high capacity factor, with compressors operating the larger portion of the time, it was decided that the plants would operate more efficiently if a mechanical type induced draft cooling tower for the jacket water were installed. The basic plan of installing mechanical cooling units called for two separate water systems: mechanical towers cooling jacket water, and atmospheric towers cooling compressed natural gas.

In the mechanical towers, jacket water can be carried at a higher even temperature for safe engine operation than would be permitted using atmostpheric towers as radical weather changes have no appreciable effect on cooling by a mechanical tower. This type operation tends toward an even distribution of heat load resulting in more efficient engine operation. The mechanical tower has a pumping head approximately 20 ft. less than that of the present atmospheric towers. This decrease in head permits the handling of some 25% more jacket water without the expense of installing larger pumps. Another feature of the mechanical towers is the fact that considerably less makeup water is lost because practically no wind driftage loss occurs in this type of tower.

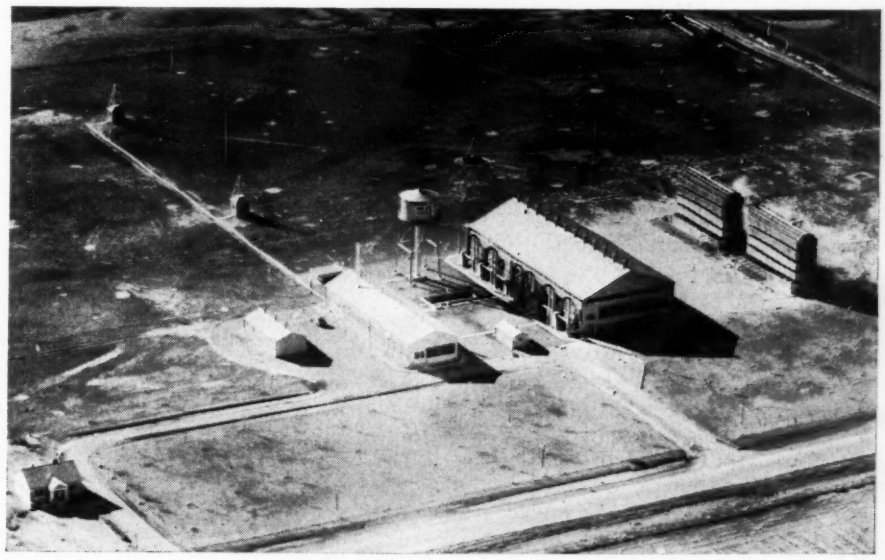
All water lines were designed to obtain the best free flow conditions possible to and from the basins of the mechanical towers. By-passes were installed in the auxiliary buildings which permit plant operators to control jacket temperature without the necessity of going out to the towers and changing valve arrangements as the wind or atmospheric conditions change.

The atmospheric towers, allocated to the cooling of compressed gas, contain single-pass gas cooling sections connected in series with the main gas inlet and outlet headers. Panhandle Eastern deviated from the standard practice of installing additional cooling sections in series by taking the present double-pass cooling coils and installing them in parallel to the inlet and outlet gas headers. This arrangement reduced the pressure drop from the outlet of the compressors to the main line outside the plant from some 10 to 12 lbs. to approximately 3 lbs. Also, the plan of spreading the gas cooling coils did not require the installation of any additional cooling equipment, the present coils in each plant being sufficient to give adequate cooling. This was a considerable saving in the cost of cooling equipment considering the number of stations involved. In connection with the spreading of the gas cooling coils in the atmospheric towers, vertical pumps were installed in the basins of the towers which recirculate the water over and over the coils. Water for makeup for the atmospheric towers under this system was changed from treated to raw water, consequently no softening treatment is necessary for this service.

2. Gas to Gas Heat Exchanger Installation for Dehydration Service

In the past Panhandle Eastern has had considerable trouble in controlling the gas temperature or contact temperature in its glycol dehydration plants. The best designed system of atmospheric cooling tower and coils did not give a low enough average contact temperature to insure complete protection for the company's pipe lines. In the Western Kansas territory, where the dehydration plants are located, there have been periods when the wind stops blowing and a calm exists. During these periods, which are rather frequent, gas contact temperatures in the dehydration plant frequently become quite high and the resulting water dewpoint is also proportionately high.

By the installation of gas to gas heat exchangers Panhandle Eastern has developed a plan of leveling out these high temperatures, using the inlet gas or suction gas from the field as a cooling medium to cool the hot compressed gas going to the dehydration plant. An analysis of the temperatures of suction gas, year in and year out, indicates that the gas sel-



Pandhandle Eastern's Greensburg Compressor Station.

dom gets over 60° F. even in late summer and cools down to as low as 40° F. during the winter months. With a properly designed bank of exchangers using this cooling medium, contact temperatures can be held between 55° F. and 70° F. throughout the year. Using these contact temperatures in a properly designed glycol plant, dewpoints can be obtained from 10° F. to 20° F. These values remain more or less constant day in and day out because of the steady and constant temperature of the gas from the field.

This has proved to be an excellent method of dehydrating natural gas without going to the solid absorbent system with its resulting high temperatures and operating difficulties. A glycol system is a continuously running, easily operated, efficient process which, combined with the gas to gas heat exchangers, brings results that prove very satisfactory for operating a long transmission line at 600 lbs. operating pressure.

Two banks of exchangers were installed, one at Liberal compressor station and one at Sneed compressor station, and up to this time no appreciable change in pressure drop across the equipment (as might be expected if any fouling takes place) has been experienced. Also, original ratings still seem to hold as to the amount of heat exchanged. However, the equipment has removable type tube bundles in the event that tubes become dirty.

3. Water Supply Problem at Louisburg Compressor Station

The main line compressor station located near Louisburg, Kan., up to this year, has used an impounded reservoir as jacket water supply for the engines and compressors. Water was pumped from the reservoir into the engines and allowed to drain back into the reservoir where it was cooled by evaporation and aeration. The installation of additional horsepower at Louisburg made it imperative that present practices of cooling water at the plant be deviated from and a standard hot well mechanical cooling tower arrangement correctly designed to carry jacket water loads throughout the year be installed. The company was confronted with the problem of using lake water for makeup, having a hardness of approximately six to ten grains depending on the season of the year. Also the water contained considerable amounts of vegetable matter and suspended material which made it very unsuitable for makeup water in a hot well mechanical cooling tower type of system.

To combat the turbidity of lake water, a stilling pond approximately 200 ft. square was constructed. Water from the lake was pumped into the stilling pond where heavy suspended mud solids were settled out. From the stilling pond, the water was gravitated to a compact filter plant. This plant consists of a mixing chamber, two settling basins, two rapid sand filters, clear well and pump equipment. Powdered alum is fed into the water as it enters the mixing chamber which causes the further precipitation of the suspended matter in the water by flocculation. From the filter plant the water is pumped to a water softener where it is softened and discharged into the plant system as makeup.

The capacities of the filter plant include the mixing chamber which is rated at a volume of 4000 gals. with a detention period of 19 minutes, the settling basins which have a rated volume of 52,000 gals. and a detention period of four hours, the filters which have an individual capacity of 100 gals. per minute and the clear well which has an operating capacity of 6000 gals. or approximately one hour's clear water supply.

The combination of settling basin, filter plant and Zeolite water treating plant gives an exact method of treating and pumping clear softened makeup water into our new water system at Louisburg.

Completion of the loop line and compressor station program has provided a system rated capacity of 333,000 Mcf. per day of sales. A peak of 357,000 Mcf. has been delivered in one day.

PIPELINE CONSTRUCTION NEWS

• To increase transmission facilities between Rio Vista field and San Pablo in California, **Standard Pacific Gas Line, Inc.** is expanding its California system by laying 24,350 ft. of 16-in. pipe, paralleling a stretch of the company's 8-in. line.

The project, to cost $227,000, will be completed this month and will furnish gas to industries in Contra Costa County as well as to three large gas and electric generating plants.

• San Diego, Calif. is seeking the western terminal of the proposed $47,000,000 986-mile, 20-in. oil line from Monahans, West Texas to California. First move toward construction of the 200,000 bbl. carrier was made April 25 when application to WPB for materials was made.

Pacific War Emergency Pipe Lines, Inc., a private company, who would build the proposed line, revealed that plans had been dropped to obtain Federal financial backing for the line. If the line is approved by PAW and WPB, it will be constructed with private funds.

• FPC has received applications for new construction to increase the capacity of the recently completed **City Service Transportation & Chemical Co.** gas line between Hugoton field and Bartlesville.

Items in the construction applied for include: (1) seven 1000-hp. gas compressor units and related facilities to be installed by the transportation and chemical company in its Guymon, Okla., station at an estimated cost of $1,298,354 and, when completed, to be operated by the gas company under a proposed lease between the two firms; (2) a cooling tower to be constructed by the gas company at its station in Blackwell, Okla., the eastern end of the Hugoton pipe line; (3) 35 miles of 16-in. loop line to be built by the gas company from Blackwell to Osage County.

• **Tennessee Gas & Transmission Co.** is arranging for a 10-year RFC loan of $44,000,000, at 4% annual interest, to finance its 1263-mile natural gas line between Corpus Christi and the Appalachian area. Funds will be repaid at a rate of $3,000,000 per year, the first installment falling due one year after the line is completed.

A minimum of 1,000,000 ft. of gas per day will be purchased and delivered for a period of 20 years.

Chicago Corp., parent of the Tennessee Co., has guaranteed purchase contracts for materials and an $8,000,000 bank credit. Chicago Corp. has agreed to finance up to $12,500,000 to complete the $51,000,000 line. Chicago Corp. has further agreed to purchase amounts of the RFC debt if the Tennessee Co.'s net earnings are less than $3,000,000 and if the latter company is unable to meet RFC serial maturities.

• **Panhandle Eastern Pipe Line Co.**, Kansas City, has applied to FPC for permission to build and operate two short natural gas pipelines in Michigan.

• **Memphis Natural Gas Co.** proposes to construct an 18-in. gas line from Monroe, La., a 61-mile extension to its natural gas pipeline between Monroe and Memhpis.

• To increase production of carbon black, plans are being considered for constructing a 60-mile pipeline to carry natural gas to existing channel carbon black plants now operating below capacity in the Panhandle area of Texas, WPB reveals.

• The War Production Board has approved the pipeline looping project of the **Pacific Gas and Electric Co.**, San Francisco, which has proposed to build 5 miles of 16-in. and 35 miles of 24-in. line to bolster deliveries between the Rio Vista field and the North Bay area industrial district. The contracts will be let on May 15, with construction to start in June.

• **The Oklahoma Natural Gas Co.** on March 30 completed construction of 5½ miles of 10-in. welded steel gas line to serve the Harrah electric power plant of the Oklahoma Gas and Electric Co., 22 miles east of Oklahoma City.

THE AIR or gas compressor has had a minor application in an oil refinery. It was used for operating tools, controls, air blown asphalt stills and perhaps a refrigeration or Edeleau plant. This was prior to the demand for large quantities of high octane fuel from the various new catalytic cracking processes. The modern refinery is now equipped with several thousand horsepower of compressors. The maintenance of such large plants is new to the refiner and has undoubtedly presented problems of a different order than those to which he has been accustomed.

Fuel Supply: The natural gas supplied by the public utilities is the best fuel source. A constant quality of dry, clean gas is desirable with the propane and heavier fractions limited to 13% or 1300 Btu. (gross) per cu. ft. It has been with reluctance that occasionally we have had to use stabilizer waste gas blended with the dry engine fuel. This practice usually results in "rough" operation or engine detonation and may eventually influence the power cylinder and bearing repair. An indicator card on a two-cycle engine will show these detonations to peak at 550 psi, where the normal peak is only 350 psi.

A constant fuel pressure is necessary to insure a uniform mixture over the full operating range. The purpose of the four-cycle engine's sensitive fuel regulator, or a gasometer, is to maintain a constant pressure of 1 in. of water. Pressure variations in the 8-oz. fuel header will make this operation

By LYMAN F. SCHEEL

Union Oil Co., Orcutt, Calif.*

less responsive. For this reason it is preferable to use one large pilot operated reducing regulator for the entire plant rather than small individual less active regulators. In other words, do not expect the sensitive regulator to perform a double duty; control the air-fuel ratio and compensate for fluctuations in upstream pressures. The two-cycle fuel injection system requires an individual reducing regulator, preferably a pilot type, to maintain a constant pressure to the governor valve.

Year in and year out fuel consumption will average 10.5 cu. ft. per brake hp. hour of 1130 Btu. (gross) per cu. ft. gas at 100% load factor; 11.8 cu. ft. at 80% load; 14 cu. ft. at 60% load. The fuel rate will hold for both four-cycle and two-cycle injection engines. Under test conditions we have always met the manufacturer's usual guarantee of 10,000 Btu. (net) per brake hp. hour.

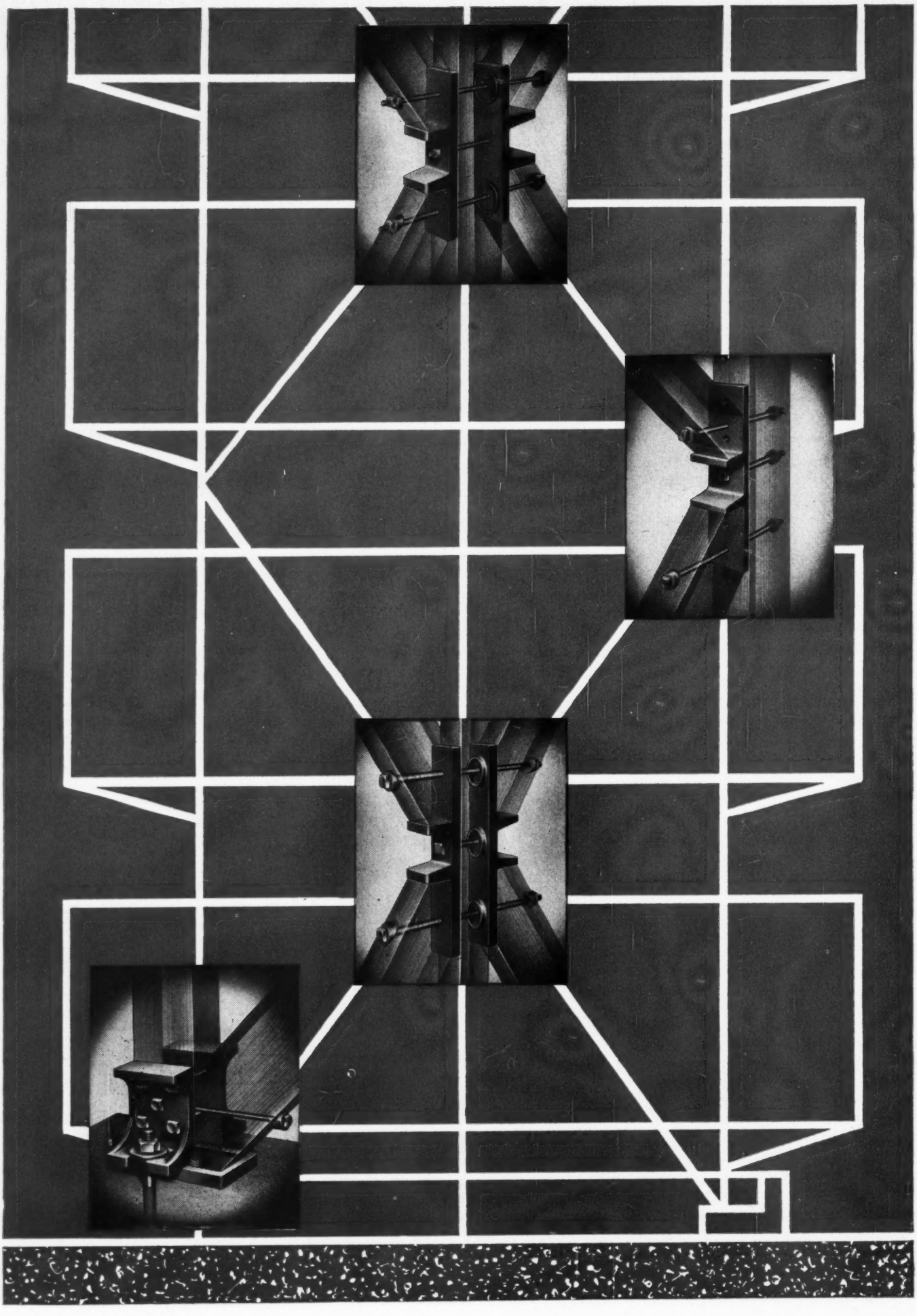
Ignition System: A low tension magneto, with a rotating field and the high tension coil at each spark plug, is the ultimate for ignition purposes. This type minimizes the corona loss that exists in transmitting the high tension spark 12 ft. on the modern angle type unit. It also prolongs spark plug life. The next best selection is the rotating high tension magneto. The oscillating type magneto is passé. Positive timing over long periods was impossible because of wear of the trip finger.

The desirable type of spark plug has a "cold body," a heavy center electrode and multiple body electrodes. The greater electrode surface gives longer firing life. A good operator will set the electrode clearance as close as possible; the horizontal two-cycle engine can be set at about .012 in.; other types, about .018 in. In the course of four to six weeks, a heavily loaded two-cycle engine will burn the electrode as much as .040 in. A four-cycle, vertical engine will burn the electrode as much as .015 in. in the same period, while the old horizontal engine will burn less than half of this amount. It is good practice to adjust the spark plugs at least once a month to insure steady operaion and protect the magneto.

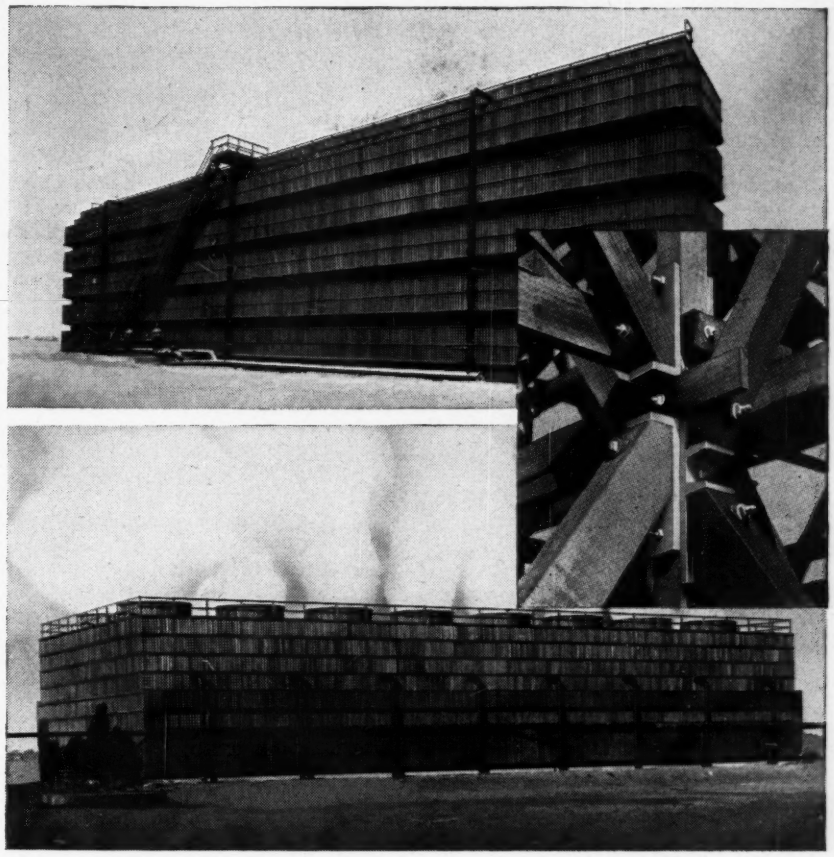
Lubrication: The mechanical maintenance of the compressor is so strongly influenced by the quality of the lubricant that one can ill afford to be critical of the price.

Lubrication engineers formerly recommended two and sometimes three grades of oil for a gas engine compressor; one for the bearing circulation or crank-case, a second for power cylinders, and a third for the compressor cylinders. We have found that one grade, generally SAE 30, is sufficient. When compressing vapors that are especially wet it is advisable to

*Presented before the annual meeting of the California Natural Gasoline Association, Los Angeles, Nov. 5, 1943.



Takes Blows FROM ANY DIRECTION



Longer life, greater structural strength to absorb shocks caused by high winds or earth movements have always been the aim in cooling tower construction. Common reasons for failure have not been due to weakness of structural members; they have been caused by stresses concentrated at the joints in excess of the strength of the joints themselves.

Conditions of temperature, wind, wetting and drying, and the corrosive action of the water have long been recognized as the major factors which cause rapid deterioration of the structure at the joints.

To meet these highly specialized requirements, the FLUOR Shear-Plate Construction (with integral connector rings) has been perfected. The most important advantage of this method of construction is that it fully utilizes the total strength of each structural member. As a result, FLUOR Cooling Towers with Shear-Plate construction set the highest standard for longer life.

Built of durable cast iron of heavy section for greater strength, the FLUOR Shear-Plate is designed to properly distribute the stresses to the various members. They are designed to last the life of the tower.

FLUOR Shear-Plate Construction is now standard on all FLUOR Aerator and Counter Flow Induced Draft Cooling Towers.

All designs for FLUOR Aerator Cooling Towers and FLUOR Counter Flow Induced Draft Cooling Towers are fully protected by U.S. Patents and Patents Pending.

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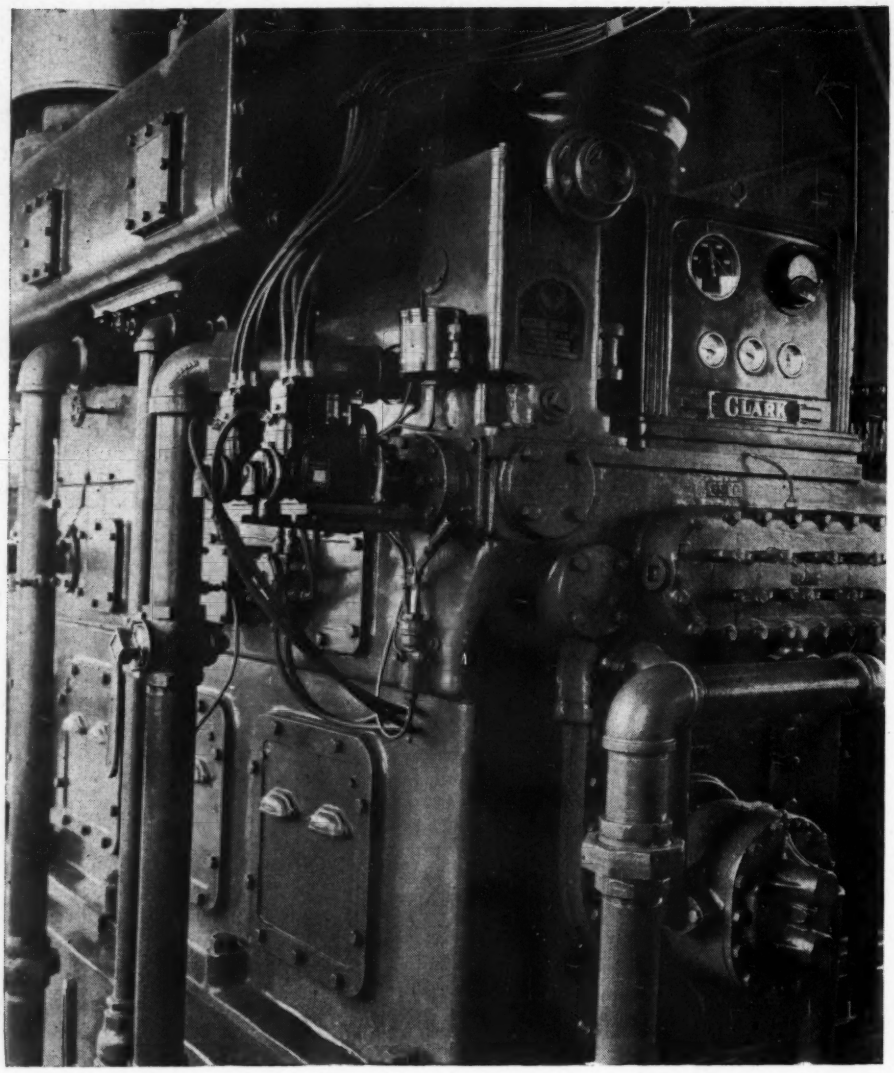


View of Clark Model RA-8 Gas Compressor. This unit has a bhp of 800 and an rpm of 300. Clearly shown in the photograph are the governor, oil filter, oil pump and condulet junction box controls. (1) Over-speed stop; (2) low oil-pressure switch; (3) excess jacket water temperature switch through the magneto.

use a compounded oil for the compressor cylinders or flush the cylinder with straight mineral oil at the rate of one gallon per cylinder. A carbon residue of 0.6% or less and a viscosity index of 80 or better, are the important specifications. Half of our lubrication problems were answered with propane-solvent refined oil; of the remainder, half are unsolved, the rest imaginative.

The problem of changing the crank case oil has been solved for many operators by filling the mechanical lubricators from the crank case circulation system. All make-up oil is added to the crank case; this will replenish the crank case contents every few weeks, keeping it in new condition. Some of the new engines are factory equipped with this feature.

The oil consumption will depend upon the type, mechanical condition of the engine and the care exercised by the attendant. Each compressor cylinder will require about 1 qt. per day, and the metallic piston rod packer about 1 pt. per day. Each hundred horsepower, four-cycle cylinder, will require 2 qts. per day; a two-cycle cylinder will require 3 to 4 qts. per day. These rates are based on filling the lubricator from the crank case. It will include the crank case loss and normal wastage. Expressed in terms of horsepower hours per gallon of oven all lubrication: the four-cycle unit will run between 2000 and 3000; the two-cycle unit will average 1500 to 2000; and the old style, four-cycle, double acting unit will average 1000 to 1500.

The problem of oil filters is highly controversial, because it is difficult to prove the superiority of one system over another. A few plants have operated years without an oil filter. This is poor practice. There is a wide selection of filters ranging from cheap muslin bags, cotton waste packs, patented chemical packs, etc., to the elaborate washing and centrifuge equipment. If the value of oil can be considered on a manufacturing cost rather than a selling price, it is difficult to justify any system more expensive than the cotton waste pack. This is especially true if the lubricators are filled from the crank case.

With some engines you can combine the oil circulation from the individual engines into a common overhead reservoir. The oil can be filtered in a single unit and dispensed to the various points without the hazard of an individual oil pump failure.

One of the recent and most successful improvements on the vertical two-cycle gas engines in recent years has been the oil cooled piston. It has increased the power capacity and piston ring life. This cooling oil will pick up about 500 Btu. per horsepower hour and must be cooled in a heat exchanger. It is advisable to cool the crank case oil in any truncated type engine where the operating temperature exceeds 160° F. Oil above this temperature tends to oxidize, to become acidic or corrosive, and to form a shellac. The desirable operating temperature of crank case oil for the modern package type unit is between 140° and 150° F. Below this temperature there is tendency to condense water vapor, to form emulsion and sludge.

Jacket Water: The key to smooth engine performance is to keep the piston and cylinder heads at a temperature below which fuel detonation occurs. This is controlled by the quantity and in certain instances, the outlet temperature of the circulated jacket water.

The jacket water in old style horizontal gas engines would absorb about 27% of the heat input at full load. A water circulation of 38 gal. per brake hp. hour would give a 10° F. temperature rise through the power cylinder and another 1° F. through the compressor cylinder. In order to obtain smooth performance and maximum output of a two-cycle horizontal engine it was necessary to limit the temperature rise to 8° F. and outlet temperature to 110° F. The usual outlet temperature of the old style horizonal engines was about 125° F.

The new package type units require a jacket water circulation of 50 gal. per brake hp. hr. As previously related, the oil cooled piston absorbs about 500 Btu. per brake hp. hr., and a like amount for the compressor cylinder. About 4000 Btu. per brake hp. hr. will be absorbed in the newly designed cylinder jackets and exhaust manifolds. The jacket water will pick up 12° F. at the above circulation. An

outlet temperature of 160° F. is generally satisfactory. The higher outlet temperatures have resulted in reduced cylinder wear.

The early proceedings of the CNGA will reveal that there was a time when economy of a closed jacket water system was questioned. There are several hundred cracked cylinders and heads that will testify that the open jacket water system is taboo. The soft water used in a closed system should carry an inhibitor to prevent the corrosion of the iron. We have found a sodium dichromate concentration of 2 lb. per 1000 gal. to be an excellent inhibitor.

Two other essential features of a jacket water system that should be included are: first, vent the jacket water system at the high point on the system, and second, minimize the back pressure on the power cylinder jacket. The power cylinders should be the last resistance in the jacket water circuit.

It has been found that it requires four barrels of jacket water make-up per horsepower month. Allow six barrels per horsepower month for your cooling tower make-up to cool the jacket water coils, the same quantity for the make-up to cool the gas coils and for the "wet-exhaust" cooling. The auxiliary equipment will consume approximately 5% of the total plant power to circulate the jacket and tower water.

Air Cleaners: The air cleaner is a desirable protection against abrasive material that may be carried in the air during dust storms, etc. We carefully micrometered the cylinder wear of power cylinders for four years that were alternately protected with air cleaners. We were not able to detect any difference in the wear. This test was conducted at Santa Fe Springs and there were no dust storms of consequence during this period. In another instance we encountered excessive wear in several air compressor cylinders and rings, operating adjacent to a construction job, where considerable dust and cement were carried with the air. The oil bath type air cleaner is most satisfactory. The dry type has not been effective in trapping fine dust particles. The cloth bag type requires more maintenance and one must accept the hazard of holes developing in the cloth bag. The oil bath type air cleaner is also an effective intake silencer, making it possible to install an interior air intake.

Exhaust Mufflers: The exhaust muffler that induces a secondary air flow around the exhaust line has proven to be an effective silencer and means of cooling the exhaust lines.

Alarms: Automatic signals and shut-down devices have proven their worth in supplementing the operating personnel. The greatest hazard in a compressor plant is the danger of carrying liquid into the compressor cylinders. This will rupture the cylinder and too often result in a fire. We always provide generous sized intake scrubbers with automatic and emergency manual drains. Should the liquid level rise above one-third of the scrubber capacity a Mercoid float activated alarm is sounded and a red light will indicate the vessel is in danger. If the level rises above the mid position, we sometimes take such drastic measures as employing an automatic magneto grounding device which will shut down the plant. Similar alarms and red lights are often used to call the operator's attention to such important changes as:

a. Low jacket water pressure.

b. Low oil pressure and/or reservoir level.

c. Abnormal pressures on compressor manifolds.

Every engine is equipped with an automatic overspeed, shut-down device to insure against a flywheel explosion, etc., in case of a governor failure. This device should be tested at least every six months, or you may find that it is not in working condition. Most engines are equipped with a low oil pressure shut-down device. Some of the new engines are provided with high jacket — water temperature shut-down devices. These devices are all good insurance.

Mechanical Maintenance: Dependability is the first requisite for the prime mover in a compressor plant. A vigilant mechanical maintenance program is the means to this end. We attempt to maintain the equipment in "new engine" condition by means of a regular overhaul schedule. This will forestall most involuntary shut-downs and minimize extensive repairs. The frequency of the overhaul is predicated upon the load factor, type of equipment and the experience of the supervising mechanic. A heavily loaded unit may require an overhaul as often as every eight months. A lightly loaded, slow-speed engine may only require an overhaul every four years. The modern angle type unit should be overhauled every 12 to 18 months. This overhaul would include:

a. Free the piston rings.

b. Remove the coke from the grooves, piston body, and exhaust ports.

c. Change or reface (when necessary) the exhaust (or injector) valves, guides, and seats.

d. Check the main and rod bearings.

e. Clean the jackets and crankcase.

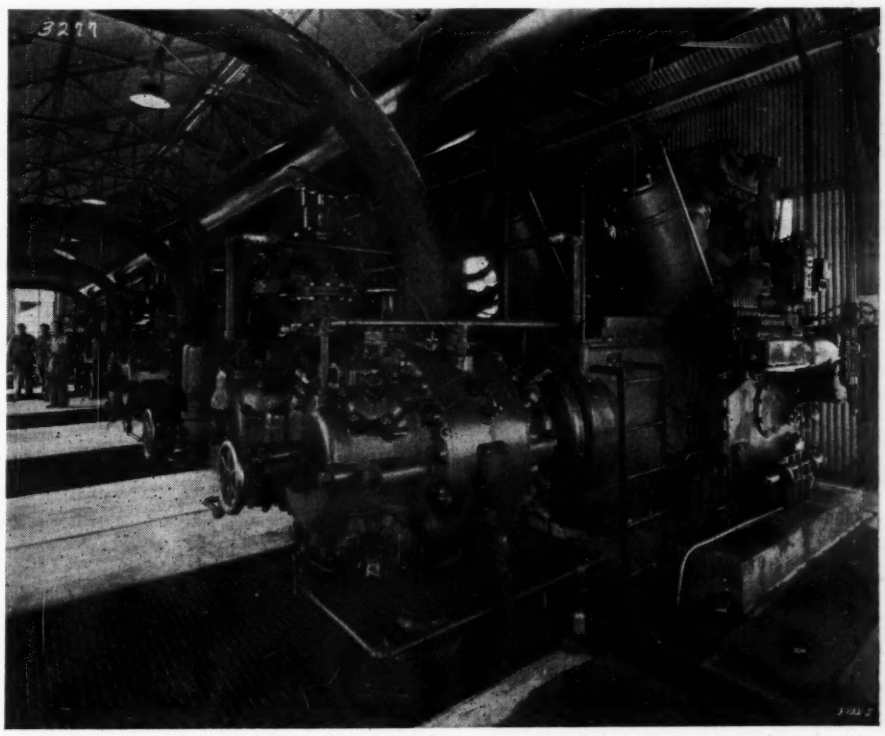
f. Change the oil filter (every four to six months.

g. Check wedge bolts, tie rods and yokes.

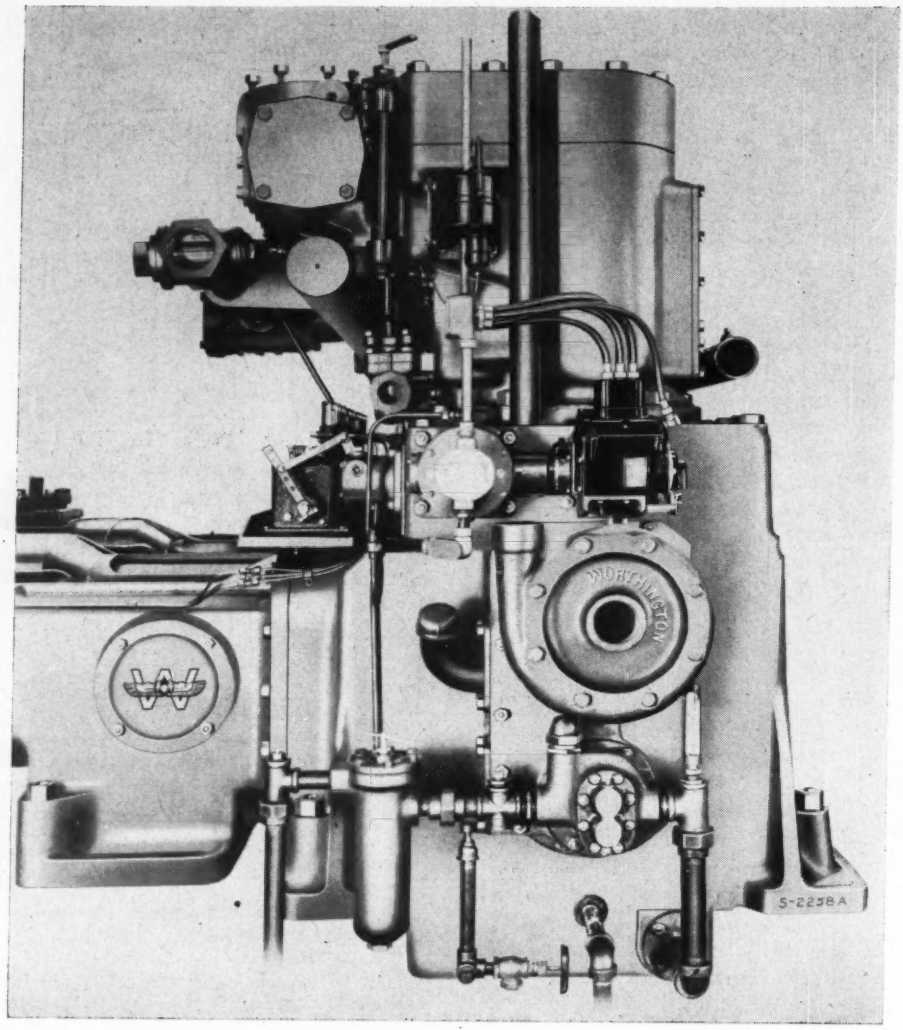
h. Clean the intake (or air) valves, governor or fuel mixer.

i. Micrometer and record the cylinder wear.

The last item is an important gauge on the effectiveness of your mainte-



Installation of Cooper-Bessemer Type GMV compressor units shown from the 2-stage compressor cylinder side.



An end view of Worthington Pump and Machinery Corp.'s type LFC unit (this is a four-cycle unit). This view shows the lubricating oil pump for pressure feed to the bearings, together with the oil strainer, the attached recirculating water pump, low tension magneto, the Bijur "one-shot" lubricator for valve stem lubrication and the mechanical lubricator for compressor cylinder and packing, and power cylinder lubrication. Also shown are the starting air connection (the plug valve slightly above and to the right of the mechanical lubricator) and fuel gas connection (the plug valve above and to the left of the mechanical lubricator).

nance program. The cylinder wear of .003 in. per year is normal for a well operated plant. After a few years of operation you may not detect any change in the cylinder wear. Some mechanics maintain that a "work-hardened" or glazed cylinder will not show perceptible wear unless you encounter abnormal operating conditions. A cylinder may wear uniformly as much as .070 in. without serious loss of power. A horizontal cylinder will generally wear "out of round" or "egg shaped"; then half of this wear will impair the piston ring action and reduce the power capacity. The average cylinder should operate for about eight years before reboring. We have run many cylinders more than twice this period. We have one plant equipped with honed cylinders whose wear record indicates that they will outlast any cylinders heretofore used. We generally rebore the cylinder to 1/8 or 3/16 of an in. oversize. We have rebored some cylinders a second time, finishing the cylinder at 1/4 in. oversize. The manufacturers have set 1/4 in. as the limit of cylinder stock that can safely be removed.

The crank bearings should have a life of three to four years. The main bearings should serve for five years or better. With a good job of babbitting and a machined fit, the bearing life will be largely determined by the care received from the operator.

A plain cast iron exhaust valve and seat should serve at least six months in a heavily loaded gas engine. A chromium alloy valve and seat with a close fit and lubricated valve stem guide will increase the life of the engine considerably.

A mechanical maintenance program of this order will require one mechanic for every 800 hp. The ratio will run as high as 1200 hp. per mechanic for the modern units and as low as 600 hp. for old horizontal, double acting, tandem equipment. This may appear to be a rather high ratio, but it represents a 16-year average for seven plants, ranging in size from 600 to 5400 hp. It includes the maintenance of all auxiliary equipment, the water and gas coils, etc. This does not mean that for every 800 hp. you might expect to have a mechanic work every fourth day on every 200 hp. engine. Quite to the contrary, our records show that we have only 0.5% "down time" for repairs. This means that, on the average, every engine is down for repairs, overhaul or check, one eight-hour day every two months. When an engine is down for overhaul or repair it is generally advisable to use a crew of four men for the old style horizontal units and eight men for the new style package units to complete the job within a day. Ninety per cent of this "down time" will be of a voluntary nature. Brief shut-downs of less than 15 minutes' duration are not included in this figure.

The important point here is to emphasize the fact that these engines do not run by themselves. Neither can you expect every operator automatically to care for their maintenance. A competent supervising mechanic who can visualize and carry out a program as outlined can spell dependability and maximum performance in a compressor plant.

Public Ownership Indicated For Canadian Utilities

Premier John Hart of British Columbia has indicated that all utilities in the Canadian west coast province might be brought under public ownership. After a conference in Victoria April 4 with representatives of Vancouver Island and Lower Mainland cities and towns, the premier stated a common ground had been reached for further development of such a program. Those at the conference expressed willingness to participate in a public ownership plan that would apply to all parts of the province and not just to areas served by British Columbia Electric Railway Co., Ltd., although the latter proposal has been under review for some time.

BCER supplies gas to Vancouver and Victoria as well as to other parts of the province. The committee in charge of negotiations with the provincial government has brought in two Seattle men, Guy C. Myers and D. Clinton Prescott, whose function it is to co-ordinate various municipal investigations and to offer suggestions on how capital is to be raised to buy out the various BCER holdings.

CORROSION AND PROTECTION

Of Buried Metallic Structures

Compiled and Abstracted by GUY CORFIELD, Technical Editor, GAS

2. Corrosion Coupons

The Cleaning of Corrosion Coupons

A. C. ALTER and C. E. LEE, Southern California Gas Co. Excerpts from a paper, "The Cleaning of Corrosion Coupons," presented before the Pacific Coast Gas Association (Pipe Protection Subcommittee, Transmission Committee, Technical Section).

CORROSION coupons are widely used in the prediction of the rate of corrosion and the useful life of metal structures subject to corrosive attack. In general these corrosion coupons are removable plates of the same materials as the metal structure and are exposed to the same corrosive conditions as the structure.

The corrosion coupons are allowed to remain in the soil a definite period of time, usually one year. At the time of their removal these coupons are covered with a considerable coating of rust and scale. In order that the correct final weight of the coupon and correct pit depths can be measured, all the corrosion products must be removed without any significant removal or addition of metal. Several cleaning methods, Table 1, are in common use and it is the intent of this paper to compare these methods.

Coupons have been cleaned by the use of a hot aqueous solution of ammonium citrate. The cleaning action here is purely chemical in nature.

Cathodic (electrolytic) cleaning methods were developed by the National Bureau of Standards. Aqueous solutions of sulfuric acid have been the most common electrolytes, but recently an aqueous solution of sodium carbonate and sodium hydroxide has been used. These methods depend upon the mechanical cleaning action of the bubbles of hydrogen forming under the corrosion products upon the corrosion coupon (cathode) in the cleaning electrolyte. In this type of cleaning method the corrosion coupon is cathodically protected from loss of metal.

The apparatus used in these tests is shown diagrammatically in Fig. 1.

The effect of current density on coupon weight (parent metal) is shown in Fig. 2 for both electrolytes. This figure shows that a current density of not less than approximately 0.1 amp. per sq. in. prevents loss of metal from a corrosion coupon in the sulfuric acid electrolyte, while in the alkaline electrolyte (sodium carbonate-sodium hydroxide) a slight but insignificant gain in weight is experienced at all current densities.

TABLE 1. METHODS OF CLEANING CORROSION COUPONS.

1. Chemical Cleaning:		
2. Cathodic Cleaning:		
	Cleaner—Ammonimum citrate	2% aqueous solution
	Operating temperature	212° F.
A.	Cleaner—Sulfuric acid	2% aqueous solution
	pH	0.6
	Current density	0.024 amp. per sq. in.
	Operating temperature	Room temperature
B.	Cleaner—(Sodium carbonate	3-5 oz. per gal.
	(Sodium hydroxide	0.4-0.8 oz. per gal.
	pH	12.6-13.2
	Current density	0.139-0.416 amp. per sq. in.
	Operating temperature	180° F.

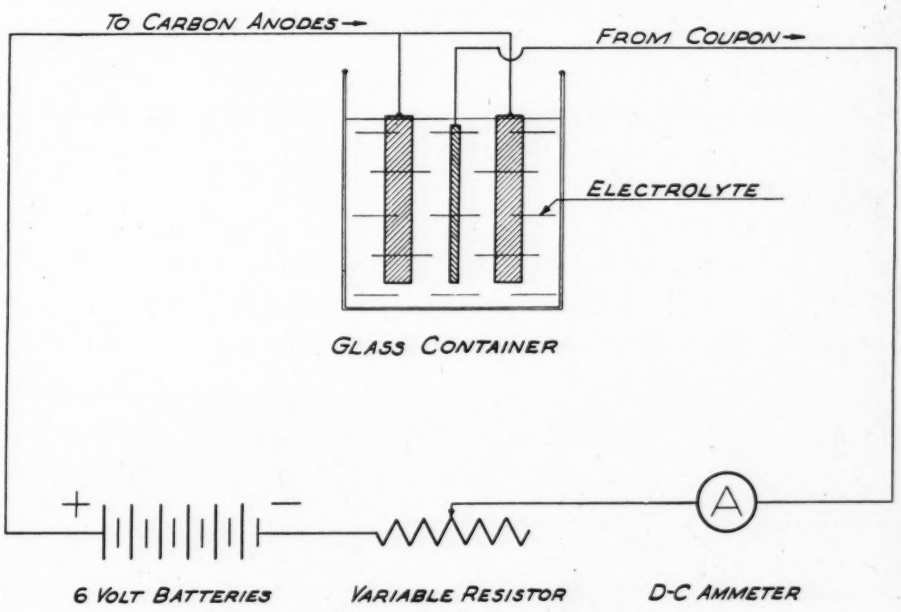


FIG. 1. Cathodic cleaning apparatus.

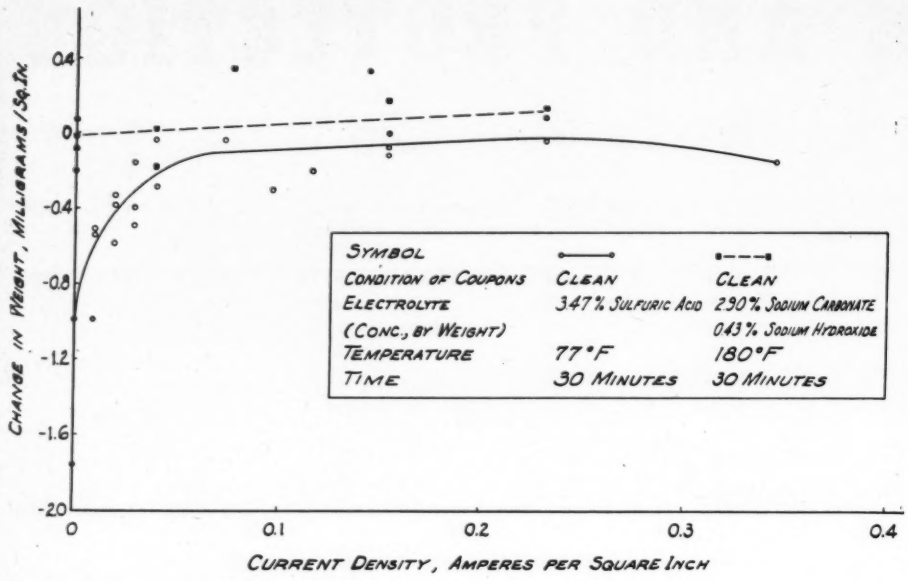


FIG. 2. Effect of current density on coupon weight.

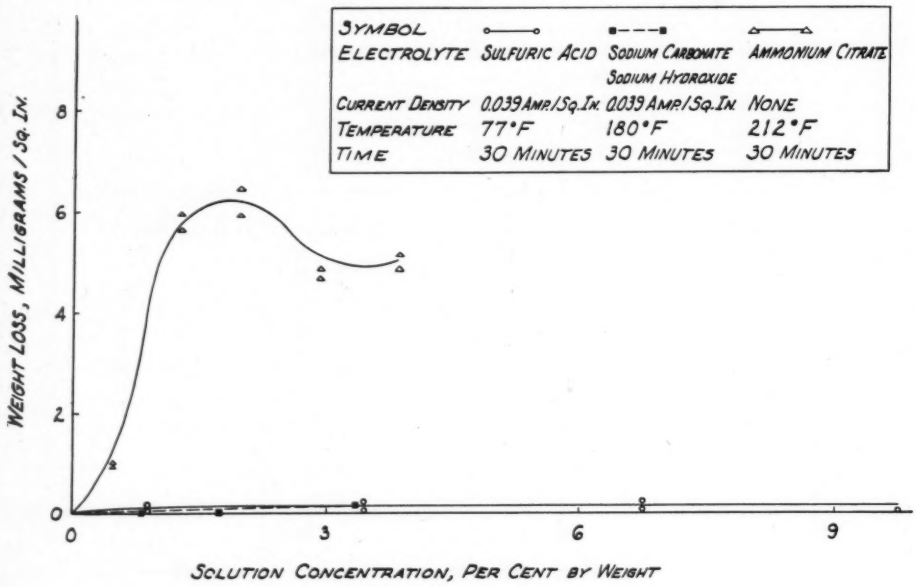


FIG. 3. Effect of solution concentration on coupon weight.

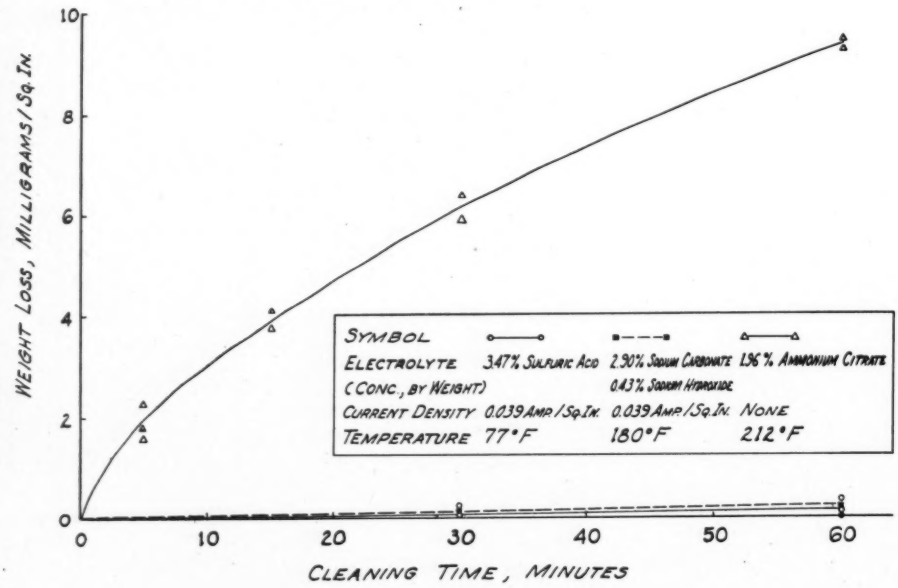
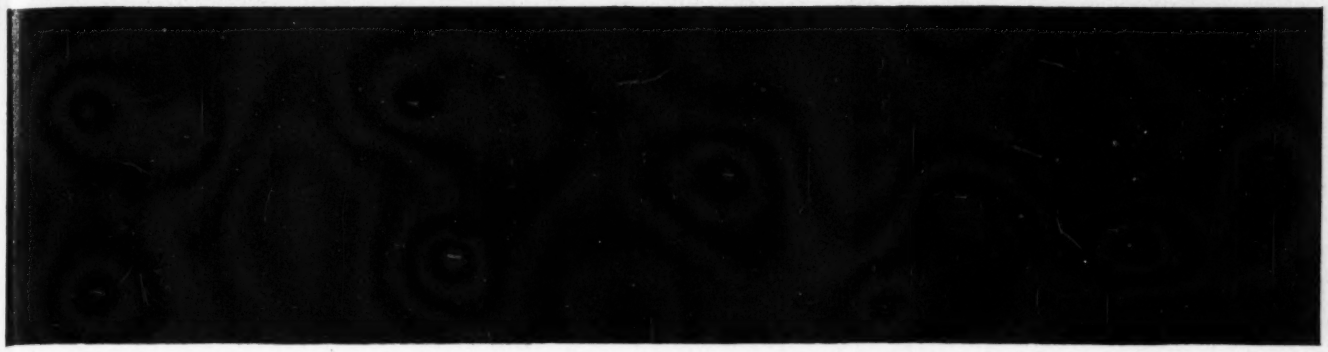


FIG. 4. Effect of cleaning time on coupon weight.

Fig. 3 shows the effect of the concentrations of sulfuric acid electrolyte, sodium hydroxide - sodium carbonate electrolyte, and ammonium citrate solution on coupon weight (parent metal). The concentration of the sulfuric acid electrolyte has little effect upon the weight loss of metal of the corrosion coupon during the cleaning process, while the concentration of the ammonium citrate solution influences greatly the loss of metal from the corrosion coupon. It is evident that an ammonium citrate solution strong enough to remove rust and scale from the corrosion coupon also dissolves a large amount of metal. To prevent contamination and changes in concentrations of the ammonium citrate solution it must be used only in a glass container.

Fig. 4 shows the effect of cleaning time on coupon weight (parent metal). It indicates that an increase in cleaning time has but little effect on coupon weight (parent metal) for cathodically cleaned coupons using either the sulfuric acid or the sodium carbonate - sodium hydroxide electrolytes. The loss of metal from the corrosion coupons, cleaned chemically with the ammonium citrate solution, increases greatly with an increase in the cleaning time, this increase being roughly proportional to time.

In order to compare the cleaning abilities of methods discussed, seven coupons, 2x5 in., were cut from a section of severely corroded 4-in. steel pipe, which was recently removed from the earth. Four of these coupons were cut from the bottom of the pipe. They were "very severely corroded," and contained several penetrations. The remainder were cut from the top of the same piece of pipe and were "heavily corroded," with pits of less than 0.050 in. Two of these coupons, one "very severely" and one "heavily" corroded, were cleaned by both methods, using the ammonium citrate solution and the sulfuric acid and sodium carbonate-sodium hydroxide electrolytes. The specifications of the cleaning methods used are shown in Table 1. Table 2 shows the results of the cleaning. Table 2 shows that the chemical cleaning method using the ammonium citrate solution removes more rust and scale from the corrosion coupons in the same cleaning period, regardless of the extent of the corrosion, than is removed from the coupons cleaned by the cathodic cleaning method using either electrolyte. However, this chemical cleaning method also produces the greatest loss of parent metal during the cleaning period (see Fig. 4). Another coupon was cleaned by the



If a shipment of pipe is necessary for the maintenance of your distribution system at something like reasonable efficiency, you can get that pipe *now* if you order cast iron pipe. To meet just such situations, our members are carrying ample stocks of both mechanical joint pipe and bell-and-spigot pipe on their storage yards. In addition, the Office of War Utilities of the War Production Board, recognizing that gas is indispensable to many war industries, as well as homes, *wants* you to maintain your gas distribution system at requisite efficiency to meet existing demand.

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Every experienced distribution engineer knows that cast iron pipe is long-lived and economical (the first cast iron gas main laid by the first gas company in America is still in service). He also knows that cast iron pipe is available with mechanical joints, tested by the A.G.A. Laboratory, and proved in the field to be bottle-tight under high pressures. And he also knows that mechanical joint cast iron pipe can be quickly and easily installed without skilled labor.

For further information, address Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, Peoples Gas Building, Chicago 3.

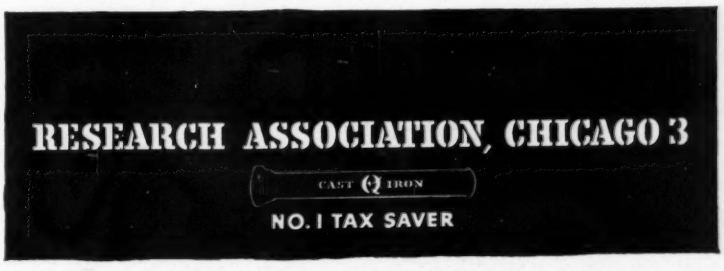


TABLE 2

Cleaning Method	Solution Concentration, % by Volume	Current Density, Amp./Sq. In.	Cleaning Time, Minutes	Temperature, °F.	Initial Weight, Grams	Weight after Cleaning, Grams	Cleaning Loss, Grams	Weight after Brushing, Grams	Brushing Loss, Grams	Total Weight Loss, Grams	Percent of Total Weight Loss Due to Cleaning
Ammonium citrate solution	1.96	-	30	212	142.6787*	140.7442	1.9345	137.2330	3.5112	5.4457	35.5
	1.96	-	30	"	259.7870**	258.1402	1.6468	257.7230	0.4172	2.0640	79.8
Sulfuric acid electrolyte	1.96	0.0385	30	77	143.4175*	142.3141	1.1034	140.0003	2.3138	3.4172	32.3
	1.96	"	30	"	264.2206**	263.1665	1.0541	261.4245	1.7420	2.7961	37.7
	1.96	"	120	"	176.4333*	173.4404	2.9929	171.7484	1.6920	4.6849	63.9
Sodium carbonate-sodium hydroxide electrolyte	4 oz/gal. Na_2CO_3 and 0.6 oz/gal. NaOH	0.0385	30	180	164.4468*	163.5755	0.8713	157.1160	6.4595	7.3308	11.9
	"	"	30	"	220.3278**	220.0147	0.3131	218.8690	1.1457	1.4588	21.5

* Very severely corroded

** Heavily corroded

cathodic cleaning method, using sulfuric acid electrolyte, and the cleaning period was increased from 30 to 120 minutes. Table 2 indicates that this increase in cleaning period results in more effective removal of the rust and scale from the corrosion coupon. A further increase in cleaning time would result in the complete cleaning of the rust and scale from the coupon without any appreciable increase in the loss of weight of the metal. This also would be true of the cathodic cleaning of corrosion coupons using the sodium carbonate-sodium hydroxide electrolyte.

It is evident that the cathodic cleaning of corrosion control coupons, using either the sulfuric acid or the sodium carbonate-sodium hydroxide electrolyte, has definite advantages over the chemical cleaning method using an ammonium citrate solution. The cathodic cleaning method is easily controlled, produces little change in weight of the metal of the coupon, and effectively removes the corrosion products.

Apparatus for Cleaning Test Coupons

H. J. KEELING, mechanical engineer, Southern Counties Gas Co. of California. Excerpts from a paper, "An Apparatus for Cleaning Cathodic Protection Test Coupons."

THE Southern Counties Gas Co. has been using cathodic protection for the past 10 years. During this period we have found no better method for measuring the effectiveness of the drainage installation than the use of weighed bare test coupons cut from sheet steel of the same composition as the pipeline.

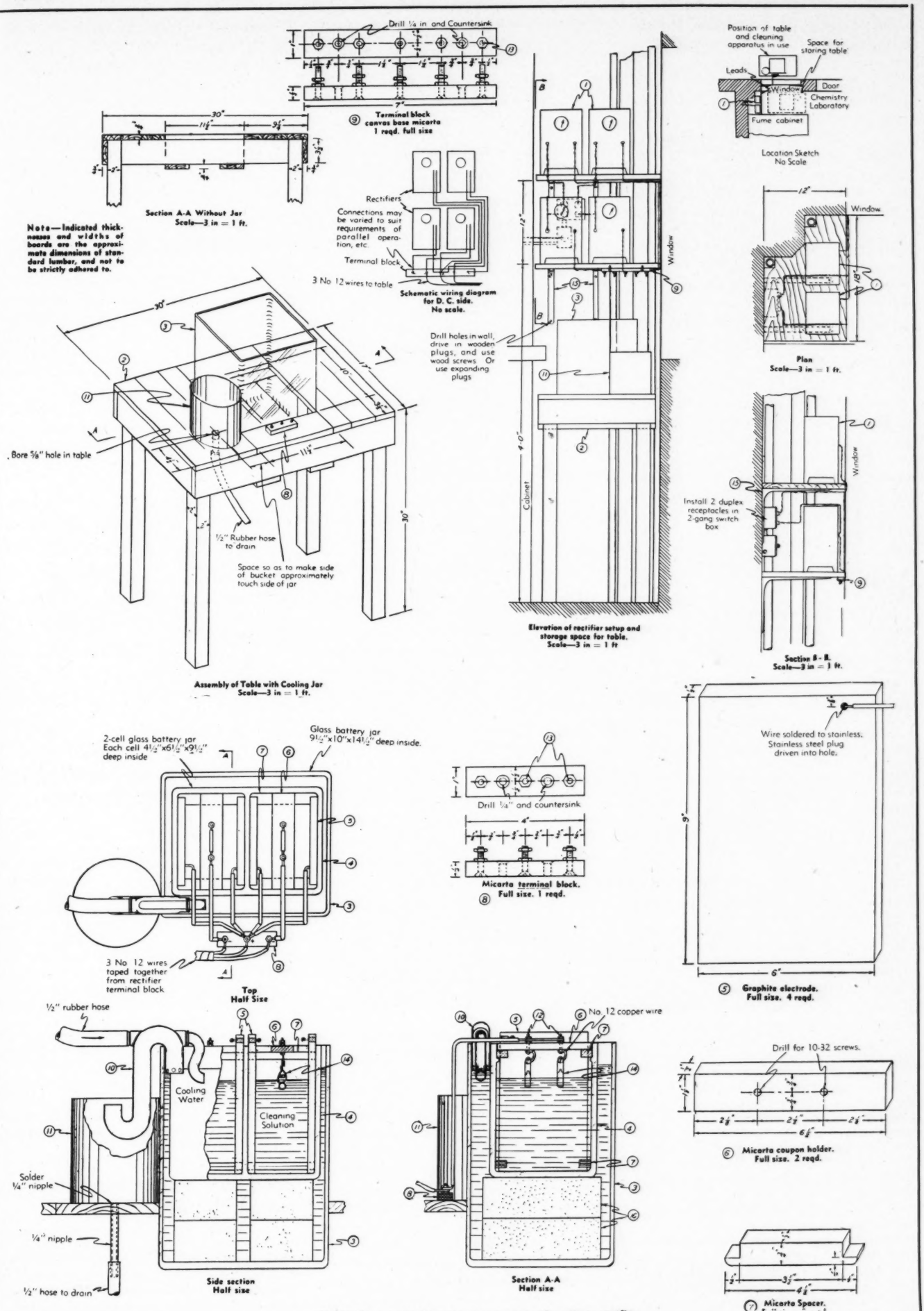
After removing the coupons from the ground they are returned to the laboratory for the removal of the corrosion products prior to weighing. In this process it is important to remove all dirt and rust without excessive loss of parent metal. The usual procedure is to use a chemical cleaning method by making the corroded coupons the cathode in an electrolytic bath of suitable composition. We have found that this method combined with a light mechanical brushing process is quite satisfactory.

Description of Cleaning Apparatus: This paper presents a detailed description of a cleaning apparatus as used by the Southern Counties Gas Co. We feel that our equipment has been successful, and the construction drawings and specifications may be helpful to other companies.

Figs. 1 and 2 are the working drawings from which the equipment was built. The tank consists of an Exide Company No. 2LXGH-15 two-cell glass battery jar surrounded by water bath through which cold water is circulated to remove the heat generated by the current. The outer glass jar is also a standard glass battery jar Exide No. EMGO-15. An Eastman Kodak Co. tray syphon is used to circulate the water in the space between the two jars. The syphon works automatically, maintaining a constant cooling water level, and the incoming stream of water from the syphon fixture moves with sufficient velocity to provide good circulation. The syphon drains into a metal overflow bucket which is connected by means of a rubber hose to a sewer drain. The water enters the syphon fixture through the small diameter rubber hose attached to the top.

The anodes in the electrolyte bath consist of graphite-impregnated carbon plates manufactured by National Carbon Co. These plates are kept in place by micarta spacers. The shape of the spacers is shown in the drawings.

The inner jar is divided into two compartments, therefore four carbon plates are used, and four samples may be cleaned at once. The cleaning operation requires about one hour per set of samples. The four carbon plates are connected by means of a positive buss to a bank of four rectifiers, and the clips used to hold the steel coupons are attached to the negative buss of the rectifiers. Tests disclosed that approximately 40 amp. at six volts is necessary to protect the four coupons from excessive metal loss in the cleaning bath. Upon investigation we found that the cheapest source of direct current for intermittent use consists of inexpensive battery charges of the dry disc type. If the cleaning apparatus were to be used continuously it would not be advisable to use such inexpensive equipment since these battery chargers were designed for only occasional use in a home garage, or similar intermittent service. *(To page 56)*


Drill ¼ in. and Countersink
Terminal block canvas base micarta 1 reqd. full size
Section A-A Without Jar Scale—3 in = 1 ft.
Note—Indicated thicknesses and widths of boards are the approximate dimensions of standard lumber, and not to be strictly adhered to.
Rectifiers
Connections may be varied to suit requirements of parallel operation, etc.
Terminal block
3 No. 12 wires to table
Schematic wiring diagram for D. C. side. No scale.
Drill holes in wall, drive in wooden plugs, and use wood screws. Or use expanding plugs
Window
Cabinet
Elevation of rectifier setup and storage space for table. Scale—3 in = 1 ft
Position of table and cleaning apparatus in use
Space for storing table
Leads
Window
Door
Chemistry Laboratory
Fume cabinet
Location Sketch No Scale
Plan Scale—3 in = 1 ft.
Install 2 duplex receptacles in 2-gang switch box
Section B-B. Scale—3 in = 1 ft.
Bore ⅝" hole in table
½" Rubber hose to drain
Space so as to make side of bucket approximately touch side of jar
Assembly of Table with Cooling Jar Scale—3 in = 1 ft.
2-cell glass battery jar Each cell 4½"x6½"x9½" deep inside
Glass battery jar 9½"x10"x14½" deep inside.
3 No. 12 wires taped together from rectifier terminal block
Top Half Size
Drill ¼" and countersink
Micarta terminal block. Full size. 1 reqd.
Wire soldered to stainless. Stainless steel plug driven into hole.
Graphite electrode. Full size. 4 reqd.
½" rubber hose
Cooling Water
Cleaning Solution
Solder ¼" nipple
¼" nipple
½" hose to drain
Side section Half size
No. 12 copper wire
Section A-A Half size
Drill for 10-32 screws.
Micarta coupon holder. Full size. 2 reqd.
Micarta Spacer.

Cathodic protection test coupon cleaning outfit.

Discussion of Cleaning Procedure: Corrosion coupons weigh about 65 grams and have an area of about 100 sq. cm. exposed to the soil. Therefore a weight loss of five mg. is required to change the significant figure in the unit weight loss from 0.0001 gms. per sq. cm. per year to 0.0002 gms. per sq. cm. per year. Thus it is permissible for the coupon to have a weight loss of four mg. in the cleaning operation without changing the unit loss figure by 0.1 mg. per sq. cm. per year. The above figures are based on samples exposed to the soil for one year. If they are exposed for two years the permissible loss during cleaning may be doubled without changing the unit loss figure by 0.1 mg. per sq. cm. per year.

Selection of a cleaning procedure was based on a permissible weight loss of four mg. A series of laboratory tests were run to determine the current density required to clean the samples effectively without exceeding this figure. It is not necessary to give complete details in this paper; however, some of the conclusions resulting from these 60 tests may be of interest.

1. We found that graphite anodes are superior to iron or lead in the cleaning bath. The use of the metallic anodes causes the coupon to increase in weight due to plated metal.

2. A 10% solution of ferric-ammonium citrate made alkaline with ammonium hydroxide used as an electrolyte in a cleaning bath is very effective. We discarded this material at the outbreak of the war, however, because it was on the restricted list, and soon became difficult to obtain.

3. Liquid glue added to an electrolyte consisting of 2% sulfuric acid increases the usefulness of this solution by lessening the weight loss without impairing its cleaning ability.

The final cleaning procedure adopted as a result of the laboratory tests is as follows:

1. The electrolyte consists of 2% sulfuric acid with 0.2% Le Page's liquid glue added as an inhibitor.

2. A current density of 0.1 amp. per sq. cm. is used on the coupons. This requires about 10 amp. per coupon, with about 4.5 volts applied between the coupon and the carbon anodes. The open-circuit voltage at the cell is about 7 volts.

3. The rusted test coupons are left in the cleaning cell for 30 minutes. They are then removed and brushed lightly with a wire brush. Any large chunks of scale remaining are carefully scraped off with a dull putty knife. This hand work requires only one or two minutes per coupon.

4. The coupons are then returned to the elestrolytic cell for an additional 30 minutes to remove all traces of corrosion from the deep pits.

5. After removal from the cleaning bath the coupons are rinsed and dried on paper towels and stored in a desiccator for several hours before weighing.

6. Repeated tests show that the average weight lost by the parent metal during the above cleaning operation is 5 mg.

7. With our cleaning apparatus we find that one man in an eight-hour day is able to clean from 20 to 22 test coupons.

Usual practice is to change all test coupons in the fall. The corroded coupons are brought into the laboratory and kept in a dry place until all the coupons to be cleaned have been brought in from the field. The cleaning apparatus is normally kept in storage and when a quantity of coupons is ready for cleaning the equipment is set up in the open, adjacent to the laboratory. We find that by applying factory production methods to the problem of cleaning the test coupons, the cost is held to a minimum.

Porcelain-Enameled Tank Standard Adopted

ON April 22, 1943, at the instigation of the porcelain enameled tank industry, a general conference of representative manufacturers, distributors, and users of porcelain-enameled tanks for domestic use adopted a recommended commercial standard for this commodity. Those concerned have since accepted and approved the standard for promulgation by the U. S. Department of Commerce through the National Bureau of Standards.

The standard is effective for new production from July 1, 1944. Copies may be obtained from U. S. Department of Commerce, National Bureau of Standards, Washington 25.

The purpose is to establish standard specifications and methods of test as a line of demarcation between satisfactory and unsatisfactory porcelain-enameled tanks for domestic water service, for the guidance of manufacturers, distributors, retailers, and users.

This standard covers porcelain-enameled tanks for domestic use in sizes 15 to 80 gal. inclusive for 300 lbs. per sq. in. maximum hydrostatic test pressure.

General requirements are as follows:

1. *Base metal.* The metal base for the porcelain-enameled parts of the tank, such as shells and heads, shall be iron or steel of a quality suitable for porcelain enameling with the process and equipment of the manufacturer so as to result consistently in tanks which will pass the tests outlined herein.

2. *Thickness of base material.* The metal shall be of sufficient thickness, so that the completed enameled tank shall consistently pass the tests as outlined in paragraph 9.

3. *Enameling.* The inside surfaces of all component parts of the tank, including fittings other than those made from corrosion-resistant materials referred to in paragraph 14, shall receive at least two separately fired coats of porcelain enamel completely covering all iron and steel surfaces which would otherwise be exposed to the circulation of the contents of the tank, and shall be free from all defects which will expose bare iron or steel or which will result in corrosion in service. These defects shall include copper heads, blisters, pinholes, crazing, and fish scales, all as defined in Porcelain Enamel Institute bulletin Tentative Definitions of Porcelain Enamel Terms. Enamels containing lead, antimony, or arsenic shall not be used except for minute quantities of these elements occurring as impurities in the raw materials.

4. *Operating conditions.* Porcelain-enameled tanks shall: (a) Withstand the normal physical operating conditions for which they are labeled, such as pressure; (b) Withstand the chemical action of their contents in the service for which the tanks are designed, such as the corrosive action of hot water in range boilers and automatic water heaters.

Detail requirements, methods of test, and instructions for marking and labeling are also included.

L. A. Companies Institute 24-hour Service Program

In order to help out war workers who are working around the clock, Southern California and Southern Counties Gas companies, Los Angeles, has instituted a 24-hour service program. Two specific conveniences are offered:

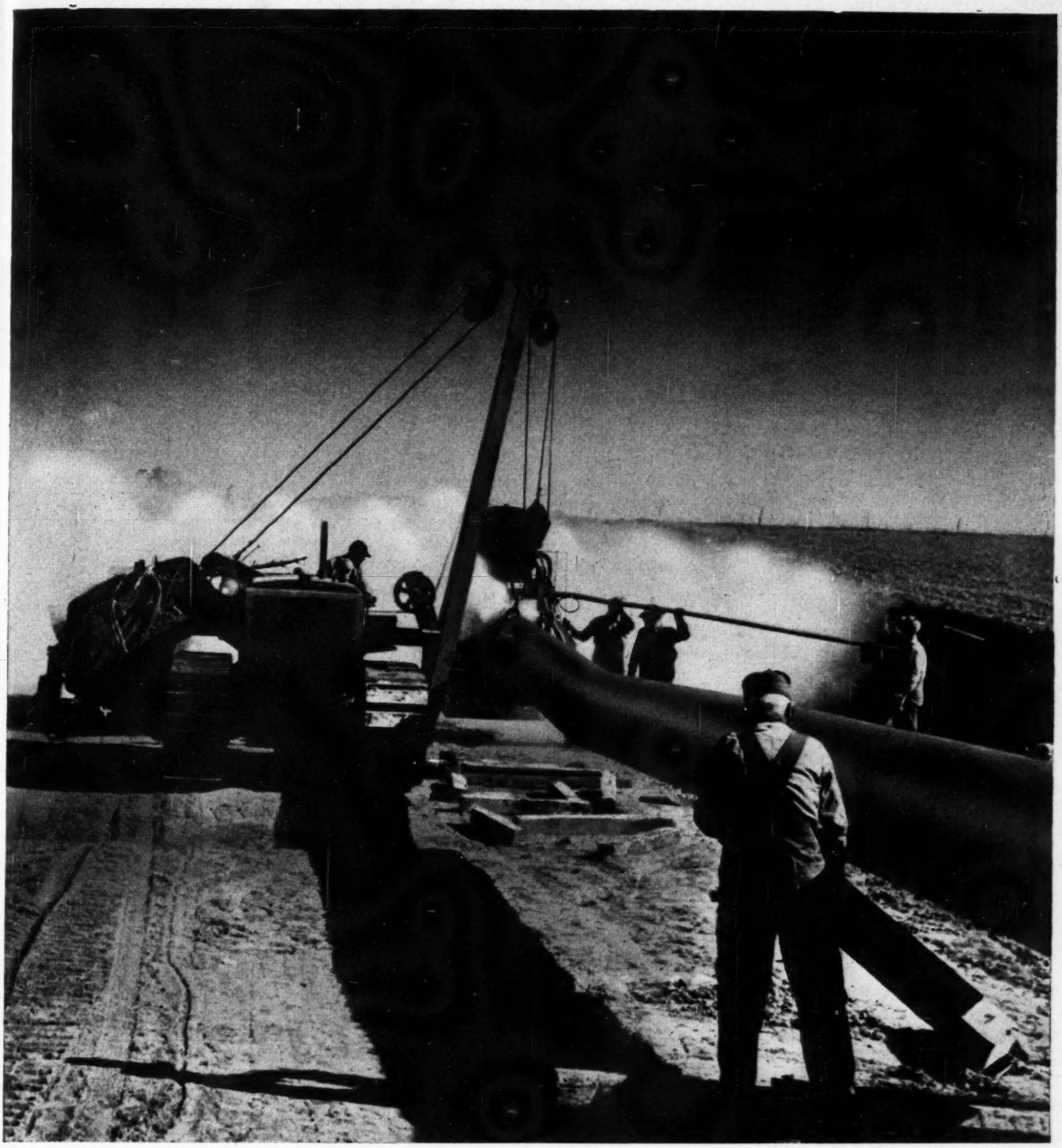
(1) An arrangement by which anyone —including newcomers to Southern California—may call in day or night and order the gas turned on or off the following day;

(2) A set-up of collection offices in stores, etc., and customer payment slots for night collections, conveniently located near war plants, enabling workers to avoid "time off" to take care of routine transactions.

Advertisements released to the newspapers in Los Angeles County carried the message of the new service policy to the combined group's more than one million domestic consumers.

Brooklyn Union Institutes Home Repairs Course

As a contribution to the nation-wide gas appliance conservation program, Brooklyn Union Gas Co. has instituted a class in home repairs. Six sessions are planned, under the direction of Clarence S. Goldsmith, distribution engineer, and John H. Waldron.



PIPE LINE CONSTRUCTION is one of the current activities of the W. A. Bechtel Co.

W. A. BECHTEL CO.

Constructors

SAN FRANCISCO

Illustrated: Cleaning and priming pipe during construction of 228-mile 26-inch gas line for Cities Service Transportation and Chemical Company. General contractor, Bechtel-Dempsey-Price.

GAS AIR CONDITIONING
Field Experience Brought Up To Date

By W. F. FRIEND

Mechanical Engineer, Ebasco Services Incorporated, New York City*

LAST autumn the Association Laboratories completed their technical investigation of equipment for comfort air conditioning with gas, and published the results in Research Bulletin No. 18. The testing work and analysis were thorough, the presentation clear, the findings convincing. This bulletin should be a valuable aid for securing public confidence in the gas industry's postwar leadership in the residential and allied small commercial air-conditiong market development.

Supplementing the investigation of design features and operating characteristics, based on models submitted by manufacturers for comprehensive tests, the Laboratories undertook a survey of field experience acquired with existing installations. About 20 gas utilities were asked to fill out data forms distributed under Joint Committee auspices, dealing with investment costs, gas and electric consumptions, cooling water requirements, general performance, servicing requirements, and customer satisfaction. A summary of findings appears in Table 1.

Recommendations for Future Work

Specific action by equipment manufacturers, utility companies or Joint Committee is not needed at this time. Manufacturers are already redesigning their units to incorporate improvements, simplification where feasible, and particularly modifications to expedite quantity production. This close analysis and detailed report of operating characteristics and servicing requirements of existing installations would be of little value to the industry.

Two suggestions, however, appear to be in order.

(1) The statistics on energy consumptions and indoor conditions produced are still fragmentary, inconclusive and in too many cases inconsistent. To aid in defining more clearly the circumstances under which summer and all-year air-conditioning loads give maximum benefits to utility companies, a comprehensive survey procedure should be devised by the Committee and put into effect soon. A proposed load evaluation method is included in the complete report.

(2) Attention of all sections of the industry should be focused on the projects now being started by the Laboratories, under direction of Technical Advisory Committee, namely, study of air-distribution principles and duct systems, and investigation of water treatment to overcome scale-deposit and corrosion troubles in cooling towers and refrigeration units. These two matters have greater influence on ultimate expansion of the market for residential and small commercial air conditioning, than any other of the elements so far disclosed by field experience.

Geographic Distribution of Installations

Comfort air conditioning with gas, which started more than 15 years ago, is now firmly established. There are some 400 installations aggregating more than 5000 tons cooling capacity, in residences and on premises of small commercial users. Most of them utilize the principle of absorption refrigeration or of absorption dehumidification with supplementary cooling. An appreciable number of gas engines driving refrigeration compressors are included, but promotion of gas as fuel for prime movers in air-conditioning service has not been active during the past half decade. In a recent article, reference was made to 100,000 tons of gas air conditioning now in operation; this higher figure includes industrial applications as well as comfort, and a number of large installations employing refrigeration equipment of steam-jet vacuum type or turbine-driven centrifugal compressors, in which the application of gas is for firing steam boilers.

Operating statistics obtained from the field last year, in survey initiated by the Joint Committee and handled by Laboratories, cover about one-quarter of the total number of installations in service; classification by equipment types is given below.

	Units	*Rated Tons*
All-year systems with absorption refrigeration		
Residential	41	183
Commercial	66	310
System with absorption refrigeration producing chilled water		
Residential	2	34
Commercial	1	8
Absorption dehumidification systems		
Residential	1	5
Commercial	2	4

The numbers of installations tabulated are not proportional to aggregate quantity of equipment of the several types produced by the respective manufacturers.

Location of more than 90% of reports installations is in the Gulf States region and in California; however, there are a few scattered installations elsewhere, including several in North Atlantic states.

Types of Equipment

Data sheets for assembling field information were arranged to fit all types and makes of gas-operated equipment, including absorption refrigeration, absorption dehumidification, engine-driven compression units and any others. In the replies, Servel absorption type comprises a large majority, i e, all but 6 of the 113 units listed, as indicated in classification below.

	Installations	*Units*	*Rated Tons*
Servel			
Residential	35	41	183
Commercial	52	66	310
Williams			
Residential	2	2	34
Commercial	1	1	8
Bryant			
Residential	1	1	5
Commercial	2	2	4
	93	113	544

*Excerpts from the Report for Joint Committee on Gas Summer Air Conditioning, presented at AGA 1944 War Conference on Industrial and Commercial Gas, at Rochester, N. Y., March 30 and 31.

SUMMARY OF MAIN CONCLUSIONS FROM FIELD DATA AND SUPPLEMENTARY SOURCES

1. Investment cost for air-conditioning installations is comparatively high — between $2000 and $2500 for complete year-round system to serve a 6- to 8-room residence.

2. Reduction of cost to $1500 level, now set as the immediate objective, will require not only production of equipment, but also simplification of field installation methods and the introduction of lower-cost "alternate" materials.

3. Factory price of equipment, including cooling tower, together with transportation charges represents 40 to 60% of total cost; air ducts and grilles with thermal and acoustical insulation where required on ducts, account for 20 to 35%; these items generally determine the overall installation cost.

4. Gas consumption by 5-ton installation serving an average house is usually between 200 and 250 Mcf. annually (1000 Btu per cu. ft.); in the South, ratio of quantities for cooling and for heating is around 3-to-1 and in the North 1-to-4 or even lower.

5. For residential installations, the gas usage by all-year air conditioning is between four and five times that attained by all-gas service for the three major domestic appliances, i e, cooking range, water heater and refrigeration.

6. Electric consumption by 5-ton residential installation with cooling tower is 3000 to 3500 kwh annually in the South and around 2000 in the North; cooling tower contributes slightly over half the consumption in the South and less than one-third of annual energy used in the North.

7. There is wide variation in gas and electric consumptions by individual residential installations; in some cases the quantities are as little as 20% of average, and in others as much as 150%; many causes are involved, some of them unpredictable and changing from one year to another, and usually related to the "human element."

8. Small commercial installations show even greater variation than residential, as they embrace such differing requirements as 24-hour 7-day lunch rooms with high internal heat load at one extreme and 7-hour 5-day private offices with small internal load at the other; however, group averages indicate investment costs about 20% lower than normal residential, and energy consumption 10 to 15% less.

9. Revenues derived from air-conditioning load, as reported on survey sheets, are at rates for the consumption incremental to customer's other load, between $0.40 and $1.05 per Mcf. of 1000-Btu. gas ($0.04 and $0.105 per therm) with majority of installations within range $0.45 to $0.65; electric rates are 1.5 to 4.5 cents per kwh, with majority between 2 and 3c.

10. Servicing difficulties are receiving close attention by utility companies and equipment manufacturers; some "modernization programs" have already been completed and others are awaiting release of critical materials; these and other measures are eliminating the principal weaknesses disclosed by field experience; already, it is practicable to institute servicing plans acceptable to customers, which will make routine maintenance a self-supporting activity.

11. Statements secured from owners and users are evidence of good reputation established by gas air-conditioning equipment and by the sales and servicing departments of utility companies and equipment manufacturers; owners are recognizing and making due allowance for newness of designs and for handicaps imposed by wartime limitations.

12. Compared to status reached in comparable development by older mechanical and electrical apparatus, such as the automobile, radio, household refrigerator, the technical advance and public acceptance attained by gas air conditioning since it started to gain momentum in the late 1930's, have been quite creditable and provide a sound foundation on which to build for the future

Main factor determining type of equipment reported is availability of data in utility-company files. Predominance of one make of equipment should not be taken as implying belief by utility companies or by Committee, that other types are not equally well suited to customer's requirements, or advantageous to utilities as source of gas and electric load.

The group of 107 Servel units is divided between the several models as shown below; those with 5-ton rated cooling capacity constitute 80% of total number and 87% of aggregate capacity.

Type	*Number of Units* A	L
Capity 3 tons		
CHA or L-3- 6	6	0
CHA or L-3-12	14	1
Capacity 5 tons		
CHA or L-5-12	13	45
CHL or L-5-18	27	1

Type designation A refers to refrigeration unit charged with lithium chloride solution, and L indicates lithium bromide used in later models. Final digits show rated capacity for heating service, i e, fuel input to burners in thousands of Btu per hour.

Williams units comprise two Model 710 and one 1014 GC. Bryant units are one each of Models 5-R, 18-R and 14-R, all provided with resaturators (evaporative cooling) to give limited control of temperature as well of humidity.

Investment Cost Data

Analysis of the 93 installations reported to Committee, which involve 113 units with aggregate capacity 544 tons, shows average and spread of installed costs for the complete systems, as summarized in Table 2. Several models rated 5 tons predominate; for these, the average costs are:

Residential	*Per Ton*
With cooling tower	$522
Without cooling tower	355
Commercial	
With cooling tower	411

There were no figures submitted for commercial installations without cooling tower. Differential shown for residential systems, with and without cooling tower, should not be taken as an indication of incremental cost for tower in a particular case; numbers of installations reflected in the stated average costs are insufficient to eliminate effect of the many variations in local features which determine overall job costs. Bryant and Williams installations appear to have costs closely comparable with the Servel.

Commercial-installation costs reported in survey are about 20% lower than for residential. This is attributable to simpler duct systems, less cutting and patching, availability of space for equipment, better facilities for performing erection work, and similar factors. Such differential is confirmed by experience of one company active in the pioneering of gas air conditioning; in years 1940 to 1942 the commercial installations completed had per ton costs 37, 23 and 26%, respectively, lower than those in residential classification.

An objective agreed upon jointly by utility companies and equipment manufacturers is to bring cost of an average 5-ton residential installation down to approximately $1500, or $300 per ton, within two or three years after manuacture of improved models is started. This will demand close scrutiny of all components of factory and field costs, and the devising of simplified erection practices along with introduction of less expensive materials. In order to judge relative importance of apparatus and of materials and labor involved in the field work, analysis has been made of past installation cost records for residential and commercial applications, to find what percentage of total cost is comprised in the main components, i e,

air-handling unit with refrigeration element, the cooling tower, and the duct system. Information entered on Committee data sheets is summarized below.

	Per Cent of Total		
	Unit	*Cooling Tower*	*Duct System*
Residential			
Rating 3 tons	55	17	11
Rating 5 tons	40	10	23
Commercial			
Rating 5 tons	50	12	15

Duct systems include sheet metal work and grilles, but not insulation; latter represents about 3% under average conditions.

For Bryant installations, the dehumidifier unit amounts to 53% and the duct system 12%. Williams installations have 37% of cost chargeable to refrigeration unit, 9% to cooling tower and 15% to duct system.

From another source there has been secured an itemization of installation cost components determined from records of 51 installations made in 1941 and 1942; the information is presented below.

	Per Cent of Total	
Itemization	*Residential*	*Commercial*
Conditioner	42	49
Cooling tower	11	12
Freight and hauling	3	4
Duct system	20	13
Grilles and registers	3	2
Duct insulation	6	4
Plumbing	4	3
Electric	2	2
Eng design and super	7	9
Miscellaneous	2	2
	100	100

Classification does not include thermal insulation for building, nor major alterations and special housing sometimes required for equipment placed on a porch or located alongside the building; these items may represent $200 to $500 where circumstances are unfavorable, and if inserted in the job cost account would materially reduce percentage figures for each of the normal components as listed.

Energy Consumption

The reported data on gas and electric consumptions demonstrate once more the irregularities and contradictions that are common in "before-and-after" determinations of energy use for a particular utility service. For example, the Laboratories' summary of gas usage shows the following average increase in annual sales attributable to Servel installations with cooling towers, made by three companies.

Model	*Number of Units*	*Gas Mcf*
3-6	1	683
3-12	3	119
5-12	18	135
5-18	8	133

First entry is impossible to reconcile with the others or with rated burner input; last entry should be higher than the one preceding, since it has fuel input rating 50% greater for heating cycle. Corresponding data for installations without cooling towers are:

3-6	0	—
3-12	4	227
5-12	1	290
5-18	2	264

These consumptions are all inconsistent with preceding group.

The same conditions are found in electric energy summary reproduced below.

	With Tower		*Without Tower*	
Model	*Units*	*Kwh*	*Units*	*Kwh*
3-6	1	12 638	0	—
3-12	3	3 734	2	1 009
5-12	15	2 248	1	427
5-18	8	2 705	2	2 250

Here the differences are in the right direction, i e, installations with cooling towers using more energy than those without, but relation between respective sizes of units is illogical.

To get usable information, it evidently is necessary to discard from averages any exceptional cases that cannot be adjusted to normal operating conditions, and to segregate installations by classes (residential and commercial) and by climatic regions. Further refinement may be needed, taking into account computed maximum cooling and heating loads. Analysis of this kind is shown on chart 1, which covers Servel Model CHL-5-12 installations with cooling towers in or near Huston, Texas; there are 11 residential and nine commercial installations represented. Annual "before-and-after" quantities and consumptions attributed to air conditioning are shown in Table 3.

From magnitudes of winter consumptions shown on chart, it is inferred that heating was done with gas fuel prior to installation of Servel unit and that the winter increase is due to automatic temperature control

TBALE 2. SUMMARY OF INSTALLATION COSTS REPORTED

(Based on Nominal Ratings of Units)

	Servel			Bryant		Williams	
	3-Ton Unit	5-Ton Unit	Multiple Units	2-Ton Unit	5-Ton Unit	14-Ton System	19-5-Ton System
Residental—with cooling tower							
Minimum	438	381	—	—	—	—	—
Maximum	538	668	—	—	—	—	—
Average	477	522	—	—	—	—	—
Residential—without cooling tower							
Minimum	—	—	572	—	—	—	—
Maximum	—	—	640	—	—	—	—
Average	542	355	600	—	—	—	—
Commercial—with cooling tower							
Minimum	518	319	360	—	—	—	—
Maximum	592	515	550	—	—	—	—
Average	554	411	435	—	—	356	314
Commercial—without cooling tower							
Minimum	—	—	—	—	—	—	—
Maximum	—	—	—	—	—	—	—
Average	442	—	—	—	244	—	—

or to the maintaining of higher indoor temperature with the improved heating facilities.

For other localities, consumption will require separate determination, especially as ratio between summer and winter loads is a function of climate. Further comments on procedure are given under a later heading.

Factors Influencing Summer Energy Consumption

Quite early in the development of residential air conditioning, sales engineers began to encounter the irregularities in seasonal amount of equipment operation and energy already commented upon. Forecasts of operating expense for prospective owners did not prove dependable, and estimates of energy sales to be derived from a given amount of installed capacity sometimes were noticeably inaccurate. To discover the factors involved, inquiries were made into the circumstances of "exceptional" cases, and the following explanations were brought to light.

1. Adequacy of indoor conditions maintained, i e, closeness of approach to ideal.
2. General reaction of owner, and likes or dislikes of any critical members of family.
3. Personal susceptibility to colds, allergic pollens, high temperatures or humidity, apparatus noise, slight drafts.
4. Severe or protracted illness in family.
5. Vacations spent away from home.
6. Week-end absences at country home, golf club, or on automobile trips.
7. Amount of entertaining done during evenings or at week-ends.
8. Ownership of valuable furnishings, art works, books, etc., affected by high humidity or mildew.
9. Willingness of owner to incur expense for operation, on borderline days or at night.
10. Dependability of equipment, i e, duration of shutdowns caused by any defects and repairs.

There are, in addition, the known elements entering into determination of peak cooling load and selection of unit with suitable capacity rating, as listed below.

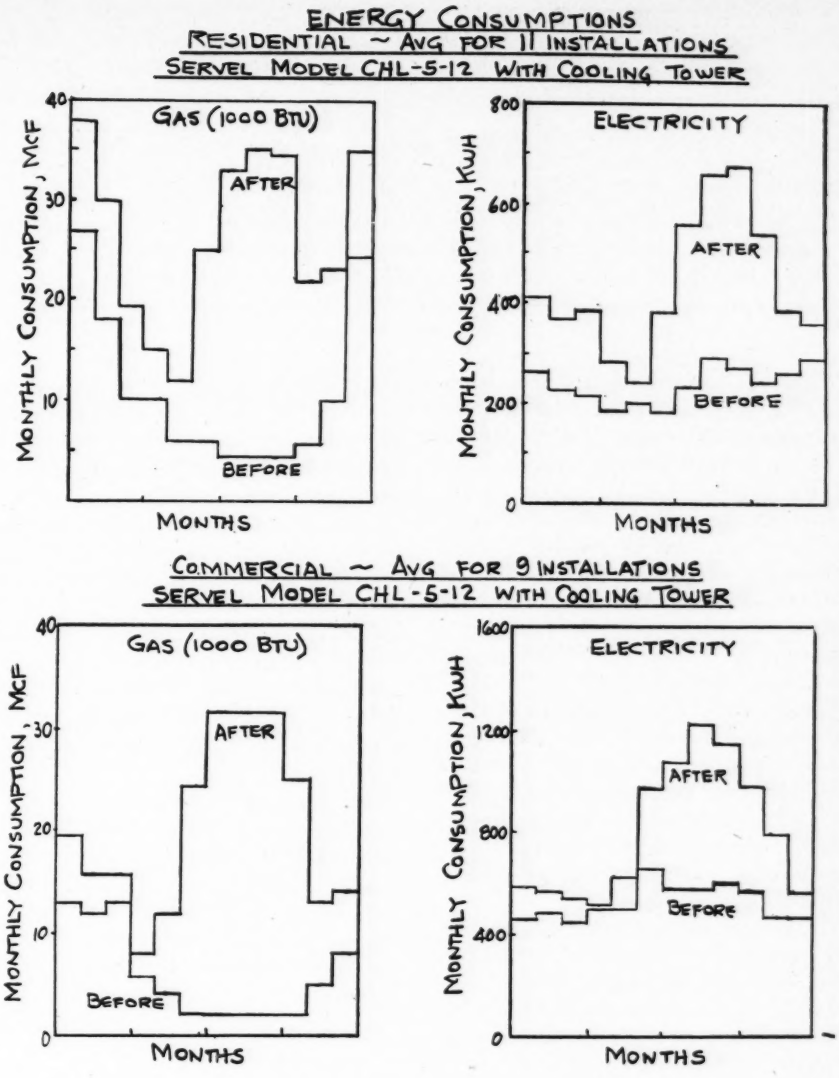
1. Local climate, as to extreme and average temperature and humidity, amount of sunshine, length of cooling season.
2. Actual cooling load, determined by: (1) Size of building; (2) Type of construction; (3) Extent of thermal insulation; (4) Exposure to direct sun, i e, shading by trees or adjoining buildings.
3. Portion of house served, i e, entire or partial with switch-over damper.
4. Amount of fresh air-supply preferred.

Since variables in first group are not always predictable, it has seemed unwise for utility-company representatives or equipment salesmen to state the probable seasonal operating expense. Instead, the preferred method is to give hourly full-load cost, and to let the prospect suggest his own figure for seasonal operating hours. Forecast of energy sales and revenues for groups of installations, say 100 or 1000 or more, should be obtainable in the future with reasonable accuracy, if statistics are assembled and properly analyzed along the lines herein discussed. However, there is a possibility that some new factors now in the development stage may affect future loads and consumptions; these include such items as:

(a) Adoption of reheat for fuller control of humidity in localities having high outdoor humidity without extreme temperature, and for applications where internal sensible heat load is low.

(b) Provision of fans giving greater air volume and static pressure.

(c) Introduction of 24-hour operation in extreme weather, permitting use of smaller air-conditioning unit.



(d) Substitution of fluorescent lighting and reduction of wattage, if illumination intensity is not raised substantially.

(e) Reduction in fresh-air quantity, made possible by use of deodorants and germicidal lamps.

(f) Greater use of thermal insulation with very low transmission factors, such as foam-type glass, rubber and plastics.

(g) Use of Thermopane multi-laminar sealed glass construction for windows.

These are applicable to existing buildings, if modernized, as well as to new construction of either conventional or prefabricated types, and may come along rapidly after the war.

Trend of Equipment Use Factor

Extent to which air-conditioning systems are used, as time goes on and owners become acquainted with benefits, limitations and operating costs of the apparatus, is of definite concern to the gas industry. If amount of operation increases substantially

TABLE 3

	Residential		Commercial		Commercial % of Resdl	
	Gas, Mcf	Elec, Kwh	Gas, Mcf	Elec, Kwh	Elec	Gas
Before air con	127	2 580	70	6 280		
After air cond	321	5 230	243	9 560		
Increase	194	2 650	173	3 280	89	123
Summer incrs.	133	1 780	143	2 480	107	139
Winter incrs.	61	870	30	800	50	92

during the second year, and holds steady or increases still further in third and subsequent years, this is definite evidence of favorable opinion on value of the service and on operating expense. On the other hand, decline in extent of use, and in gas and electric consumptions would call for close investigation of local circumstances and taking effective action to remedy any deficiencies found or to lower the operating costs.

Equipment manufacturers and installation contractors are concerned mainly with use trends in so far as they influence the future market: utility companies are more vitally affected because revenues from the load constitute their sole interest in promoting air-conditioning business.

Investigation of use trend has not yet received the attention it deserves from the industry as a whole. Admittedly it is difficult, because of complicating factors such as year-to-year climatic variations, changes in users' requirements, and alterations made in building or in the equipment. Variation of 20% in degree-day heating load and 40% in seasonal cooling and dehumidification demand for successive years is not uncommon; however, consumption records can be adjusted accurately enough to eliminate these variables. The troublesome elements are those relating to occupancy, structure and appliances—both difficult to correlate with air-conditioning energy use. Provision of separate meters would help; however, the recent tendency has been to remove those meters which were provided, because of wartime materials shortage.

In the majority of cases, estimates of consumption chargeable to air conditioning must be derived from customer records for the year "before installation," which become less trustworthy as time passes; their usefulness will decrease still further after the war, when wornout appliances and obsolete lighting systems are replaced with new types.

An analysis to determine consumption trend has been made by New Orleans Public Service, for five residential and five commercial customers with Servel Model CHA units; in each group, 1 unit is 3-ton and remainder are 5-ton. Climatic conditions for the 2 years are:

	1942	1943	Change
			%
Cooling, degree-hours excess 85°F base	2602	3298	27 increase
Heating, degree-days deficiency, 65°F base	1357	1164	14 decrease

Estimated energy consumptions for the two groups of air-conditioning customers are shown in Table 4, with second year's values adjusted by multipliers which are the ratios of degree-days and of degree-hours.

There is noticeable increase in second-year use for cooling, by residential customers, but decrease is shown in the case by commercial customers. For heating, trend appears to be reversed. Agreement between gas and electric consumption trends is not close; last-line entries for commercial heating indicate 3 times as much increase in electric consumption as in gas.

Further work along these lines, to devise simple and dependable methods for detecting use trends, appears desirable as a future Committee activity.

Servicing Experience

In the interim since field data on servicing problems and customer satisfaction, derived from 1942-1943 operating experience, were submitted to the Committee, comprehensive analyses of service causes, methods and expense were prepared by the utility companies having majority of gas air-conditioning installations in their territory. The studies include classification of service calls, man-hours time spent, materials used, hourly cost per call, transportation expense, and allocation of costs between utility, manufacturer and customer.

These show a changing picture. Modernization of early models, progressive elimination of inadequate or defective parts, greater skill acquired by service mechanics—all have tended to reduce the frequency of routine and emergency calls. Equally important is the experience gained by owners as to how the equipment behaves under normal conditions; this has decreased the number of calls "without cause" substantially.

Among outstanding problems, those of water treatment to prevent scaling and corrosion of cooling towers, heat transfer devices and steam generators

TABLE 4

	As Reported				1943 Adjusted to 1942 Basis		Change, Per Cent	
	Gas, Mcf		Elec, Kwh					
	1942	1943	1942	1943	Gas	Elec.	Gas	Elec.
Residential, without tower								
Cooling	122.6	173.1	1092	1424	136.5	1127	11 incr	3 incr
Heating	91.3	79.0	700	568	91.8	651	1 incr	7 decr
Residential, with tower								
Cooling	119.3	174.3	3430	4870	137.5	3840	15 incr	12 incr
Heating	91.3	79.0	700	568	91.8	651	1 incr	7 decr
Commercial, without tower								
Cooling	99.6	118.1	907	1137	93.5	898	6 decr	1 decr
Heating	49.5	48.4	320	394	56.3	458	14 incr	43 incr

require the largest amount of work still to be done. Supplementing the detailed studies along these lines, which equipment manufacturers now have under way, AGA Laboratories is starting a general survey of field conditions and requirements. Troubles from unsuitable water have confronted the entire air conditioning industry since its inception; at annual meeting of ASHVE last February, recommendation was made that corrosion and water treatment be included in general research program sponsored by the Society.

Customer Satisfaction

Only 23 of the 93 installations covered by field reports included statements as to degree of satisfaction expressed by owners. Opinion is classified as follows: excellent 18, good 1, fair 3, poor 1. The three makes of equipment are merged in the customer-satisfaction summary, as their status appears to be similar. The survey results are supported by more complete canvass of air-conditioning users completed by one utility company; in more than 90% of cases, opinion given was excellent or good.

Post-war Importance of Gas House Heating

By HENRY O. LOEBELL

Chairman, AGA Subcommittee on Economics of House Heating*

TWO forces dictate why the gas industry must re-appraise the house-heating load in the postwar market:

1. The house-heating load provides an opportunity for new earnings because of the load itself and the opportunity for increasing the earnings from old domestic customers, as well as the advantages it offers in new homes for a larger share of domestic services.

2. The house-heating load also might possibly become the only alternative to solvent survival in the future.

If these premises are accepted, the industry cannot afford to lose much time in determining its intent or policy in entering this market. There is no time to see if the competition is going to make inroads, or if the public is going to be receptive.

Given the premise that the house-heating loads must be developed, the industry must analyze the opportunity offered by such loads as it may be able to secure with existing facilities, and also what must be done to make economically feasible new facilities for loads greater than existing facilities can serve.

For this is needed a basis computing the costs that make up the total cost of serving different kinds of customers. A quick analysis of costs will disclose that they are made up of three major elements:

1. The customer costs, which vary with the number of customers. House-heating does not impose extra costs (except special service).
2. The demand cost, which varies with demand imposed by each type of customer computed on a daily or hourly basis. House heating does impose extra costs because of its high winter demands.
3. The commodity cost, which varies with the volume used by any customer. House heating imposes no extra cost (except as it is desirable to provide costlier enriching materials in order to raise capacities).

It is known that if service at a low enough rate could be provided, the gas industry could secure all or the major part of the house-heating load. Although the industry is not in this fortunate position, it must secure the greatest possible amount of house heating with rates that are profitable, and must aim to reduce costs so that a greater scope can be given to this business.

Without going into details of these cost elements, and to get to the vital part of the problem, it can be stated that:

1. Since an average house-heating customer buys 10 times the volume of domestic gas as compared with a straight domestic customer, the incremental customer cost remains the same. Hence the volume served for house heating only has no customer cost, save insofar as the cost of servicing the house-heating equipment is made a part of this cost.
2. The commodity served for house-heating is generally the same as for general distribution; hence house-heating gas, as such, is not higher in cost than the holder cost for any other service (except as mentioned before).
3. Since the facilities required to supply the volume required for house-heating are useful only to the equivalent of 27.4% of the year, the demand cost is over three times as great as the cost of facilities that are in use every day in the year.

Thus there is an advantage in customer cost and a disadvantage in demand cost in serving the house-heating load. The major facilities that cover the demand costs are plant and distribution.

Specific data nationally applicable as to what these demand costs are is needed. The technical section of the AGA has undertaken these studies and will report on this matter soon.

In the interim, having identified the problem, steps can be taken to find out what can be done about it: (1) as a necessary requisite for immediate action and, (2) as a guide to the direction in which improvement must be made for the future.

For Immediate Action

Plant Capacity: On the assumption that present equipment available is now a part of the total plant cost, any house-heating customers served by the existing plant do not involve new demand costs, except, perhaps, a larger meter. The house-heating market can be extended first by employing the unused capacity of the facilities available and, second, by locating the piece of equipment or the facilities in the plant such as blowers, exhausters, coolers, purifiers or whatnot that today are the bottlenecks in maximum plant capacity.

The opportunity of using liquefied petroleum gas, high superheated steam, higher static pressures during the make periods, etc., that would increase the capacity of the existing plant, should also be explored. These and other suggested means of increasing plant capacity are also currently being studied by the technical section. These means will offer the opportunity to start the house-heating effort with assurance that there is some plant capacity available.

Distribution Facilities Generally Adequate: So far as distribution is concerned, studies made thus far do not show any serious deficiency in distribution capacity. In fact, it is the

*Excerpts from an address, "The Importance of The House Heating Load," presented by Mr. Loebell, consultant, Surface Combustion Division, General Properties Co., Inc., before the Annual Business Conference of the New England Gas Association, Boston, March 23, 1944.

judgment of prominent distribution engineers that existing distribution systems are generally ample up to as high as 20% house-heating saturation; also, that by changing some of the systems to intermediate pressure, ample capacities can be secured for maximum house-heating service. To be sure, every distribution system may have some weak spots but, generally, they are not hard to correct.

The Question of Rates: These are vital to the industry and to the development of this new business. While costs of raw materials and labor have gone up, they have been at least in part counteracted by increased loads. Higher costs will probably continue after the war, so costs must be reviewed in the light of these increases. Since rates cannot now easily be raised to compensate for this increased cost, it would be advantageous, if feasible, to wait until after the war to make any change in the existing rate or rate structure.

The consideration for this viewpoint is prompted entirely by the psychological influence that a rate increase may have before any competitive picture is evaluated, rather than by the economics of the service or the earnings position of any company. In other words, any agitation for rate increase before the public knows what competitive costs will be, may have adverse effect on the specific market. Each company must decide for itself the effect and the advantage of any rate changes now or in the immediate future.

Because this part of the discussion deals with new house heating that can be obtained from available equipment, the justification for a rate change exists only if the present rates do not cover the incremental cost of gas as produced today or will be produced in the near future.

Sales Effort Must Be Planned: This sales effort must be impressive enough to arrest the attention of every householder. It must reflect the viewpoint that the industry has decided that everybody can use gas for house heating. It must reflect the announcement of a new era of gas service, and it must reflect a new decision predicated on new accomplishment by the gas industry. For such a procedure, an adequate plan is needed as well as ample manpower and funds with which to accomplish the purpose.

To summarize, the entire theme of the immediate, or short-range, viewpoint of the house-heating load in order to take on certain amounts of that business, is to increase the capacity of the facilities now available to their maximum capacity. The rates must be reviewed to be sure that they are compensatory, and the sales effort planned adequately. Let it be known that the gas industry is in the business to serve this load.

The reader is directed to the large number of factual studies presented on this subject, particularly to the recent studies presented by the Market and Economic Research Committee, as well as the recently issued reports on competitive factors affecting the realization of potential markets in the postwar era.

Long-Range Viewpoint

The specific problem the gas industy has in economically serving the public with gas for house heating is largely the fact that, since the gas industry has been based upon high load factor operations, there are not the equipment nor the facilities to economically produce gas that is sold at low load factors. Hence the problem of production for low load factor business is relatively new. As previously stated, the distribution of gas with low annual load factor, but with high daily and hourly load factors, is not a serious handicap, nor does it mean unduly expensive service. Therefore, the only elements of service cost which vitally affect the low load factor service are the production equipment costs.

Hence, as a prerequisite to the solution of this problem, the elements of cost that make up this investment in production plant must be carefully examined. To accomplish this requirement two things can be done: First, study the equipment available now, with the thought of reducing its cost to the lowest point possible; second, from this study formulate an objective, or set up the ideal plant, that would meet the problem of low initial investment.

The manufacturing equipment now in use is either the coal carbonizing plant, using a variety of methods and design, or the carburetted water gas machine. The coal carbonization plant, because of its high initial cost and because it must of necessity dispose of the coke produced at a premium, is generally unfit to meet the economics of house heating, save in those rare cases where the coke goes entirely to the industrial market. Hence the carburetted water gas machine is the only gas-making equipment that more nearly meets the industry's needs.

The parts that make up a carburetted water gas plant consist of buildings, holders, boilers, exhausters, blowers, piping, coal handling, scrubbers, coolers, purifiers, etc., in addition to gas production sets. The gas-making apparatus as such seldom exceeds more than 15% to 20% of the total costs.

It is suggested that plant costs be itemized to reflect each function, and see how they can be reduced or possibly eliminated, so that the total cost is lowered.

The thinking behind such an analysis must not be thinking prompted by what has been past practice but—and this is vitally essential—thinking based on the principle that because it has not been done before, it is not necessarily impossible now.

At any rate, such minute analysis of equipment costs will do two things: It will show what can be done to reduce the cost of the water gas machines, and it also will crystallize the ideal gas-making machine for the industry. In line with this thought, engineers representing large utility companies have given assurance that stripped water gas plants for peak gas production can be installed at approximately only one-half the cost of the standard water gas machines. For faster progress, it may be well to invite manufacturers of water gas machines to help with this problem or, if feasible, put the problem up to the manufacturers of other equipment.

New Gas-making Equipment: It must be an outdoor production unit that has a self-contained steam generator, thereby eliminating most of the buildings and the boiler plant. It must operate continuously and generate gas under pressure, thereby eliminating some holders, exhausters and compressors. It must reflux the unchanged raw fuel to reduce scrubbing and cooling to a minimum. The functional characteristics of such a plant should be similar to a plant handling fluid material, so that it can be operated automatically with a minimum of labor. And lastly, it should use the lowest cost raw material available.

This ideal plant can serve as a pattern for improvements required in the water gas machine if the water gas machine is adaptable to these changes. If not, there is no alternative but to start from scratch and develop gas-making equipment that would incorporate all, or the major portion of, these desirable characteristics.

This, some may say, represents the millennium. It may look impossible to some, absurd to others. Nevertheless, it represents the objective of the gas industry, if it is to fulfill its function completely and deserve the opportunity that the house-heating business offers.

An Automatic Industrial Gas Furnace

By R. LLOYD FRENCH

United Gas Co. of Canada, Ltd.
Chatham, Ontario*

IN OUR particular area the predominant industries are automobile plants and their associated industries. Therefore, equipment trends such as are encountered will only be of interest to those called upon to supply fuel and equipment for large scale production.

In this connection, continuous gas carburizing is one of the greatest achievements in use of gas in industry. The particular furnace under discussion is a muffle pusher type re-circulating gas carburizer, having an allowed dimension of 42 ft. in length, 7 ft. in width and 13 ft. in height.

This firm formerly used the old conventional type of pack carburizing with a total furnace capacity of 3700 lbs. per cycle. This operation required three men, three hours to hook the boxes and load the furnace. Two and one-half hours were required to bring the furnace up to carburizing temperature of 1700° F., and the charge was held at that temperature for eight hours. It then took two hours for the furnace to cool down low enough to permit the removal of the boxes, and 2½ hours to remove the boxes from the furnace and to handle the finished product.

Let us briefly summarize the old box type operation:

Total man hours per cycle	16.5
Total firing hours per cycle	10.5
Total furnace hours per cycle including cooling	12.5
Total pounds per cycle	3700
Total cost per pound—finished product	$.025

Today in this plant, one man loads the material onto cast trays on a roller conveyor at the charging end of the furnace. The furnace has a vestibule 32 in. wide, 16 in. high, and 24 in. deep. This vestibule takes two rows of trays, one large and one smaller. Every 30 minutes the vestibule door opens automatically along with gas flushing valve, allowing raw gas to enter, driving the oxygen from within. The ram then pushes the material inside, the door closes. This load stays in the charging vestibule until the next push, when the second or inner door opens, allowing the material to enter the main chamber or muffle of the furnace, where it comes in contact with the re-circulated gases and carburizing begins.

The maximum amount of heating gas used per hour is 2000 cu. ft. Three hundred to 350 cu. ft. per hour of raw gas is used for carburizing, regulated by floscope. The calorific value of the re-circulated gas before addition of raw gas is 480 Btu. The value of the re-circulated gas after addition of raw gas is 560 Btu., an increase of 80 Btu. per cu. ft.

The analysis of this carburizing gas is as follows:

CO	0.0%
CO_2	3.0%
CH_4	37.8%
H_2	54.9%
N_2	4.3%

There are approximately four temperature zones in the muffle stepping from 1000° F. at the charging end to 1700° F. at the discharge end.

As the operation continues, a second man removes the finished product with a hook at the discharge end, through a small door, built in a large sliding door on the discharge vestibule. This sliding door rises and lowers according to the height of the pile of material and spacers. The material is then quenched in oil.

The total load per 12-hour cycle, 24 pushes, of this particular furnace is 9304 lbs. This includes 48 trays, spacers and stock. The hourly capacity of finished product is approximately 712 lbs. Cost per pound is 4/10 of one cent. Old type operation resulted in 276.4 lbs. per hour at a cost of 2½ cents per lb.

May I conclude by saying, the process is much cleaner. Through the elimination of packing materials, the maintenance of boxes is cut to a minimum. The case can be more accurately controlled by increasing or decreasing pusher or conveyor speeds, depending on the size and type of material to be carburized.

Grain size can also be more accurately controlled, since the material can be held at a much closer temperature than is possible with the old pack methods.

*Remarks at Industrial Gas Round Table, National Metal Congress, Chicago, Oct. 20, 1943.

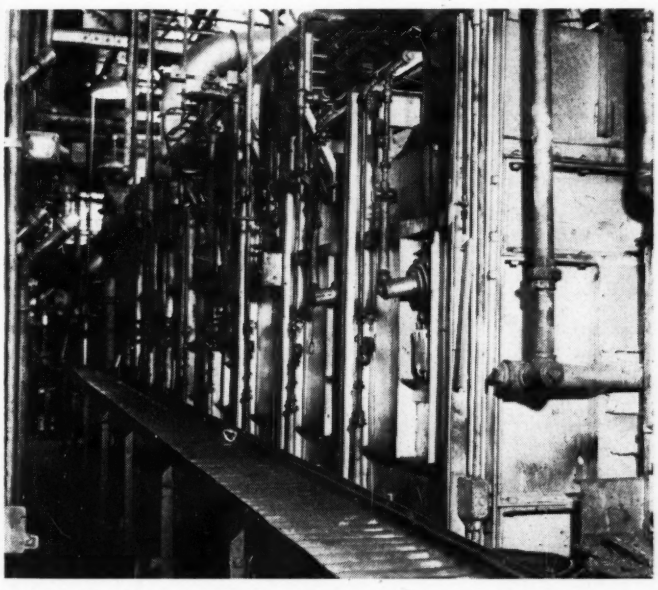


FIG. 1. Muffle pusher type re-circulating gas carburizing furnace.

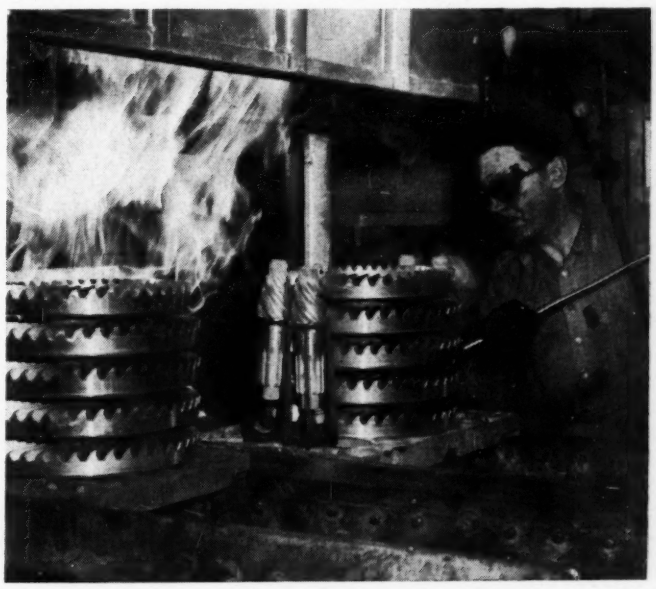
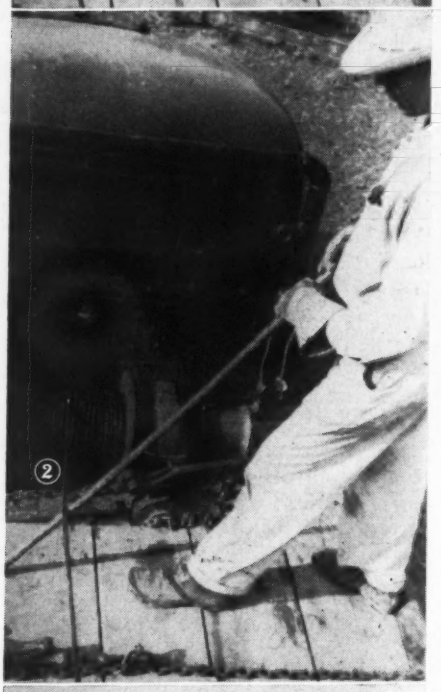
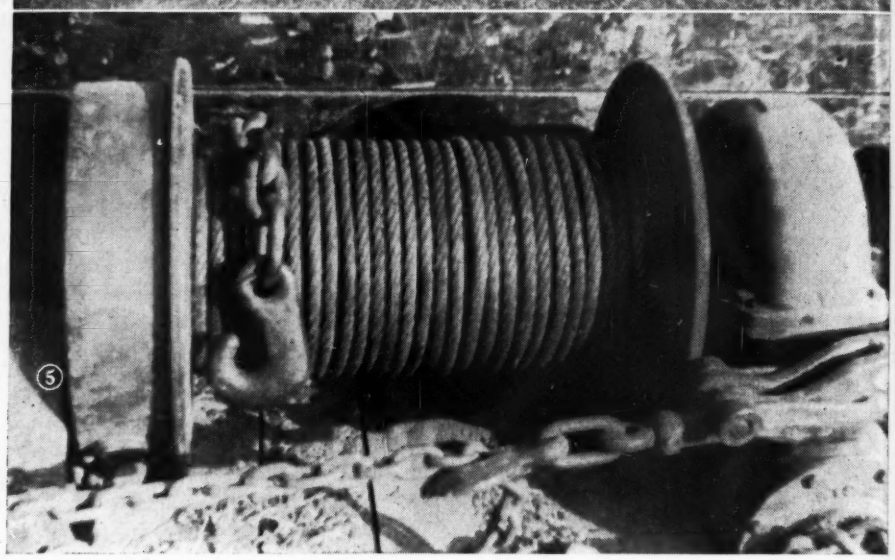


FIG. 2. Loading onto cast trays on a roller conveyor at the charging end of the furnace.





Hazards and Precautions in WINCH OPERATION

TO handle heavy materials used in pipeline and production operations, most company trucks are equipped with winches. In addition to safe mechanical maintenance, certain operation practices must be observed to avoid accidents. Pictures shown are based on suggestions in "Safe Practice Suggestions for Pipeline Operations." They illustrate hazards and precautions in using winch equipment.

(1) The wrong way to guide a winch line.

(2) The correct method: using a bar.

(3) Hazard of permitting winch line to be pulled through bare hands. Gloves should be worn and hands kept moving with line in spooling.

(4) Danger of standing in arc of a line fastened to an object. If line breaks, serious injury may be inflicted by rebounding line.

(5) Winch line properly spooled on drum. If it is criss-crossed, pressure will wear and break small wires of which line is fabricated.

These photographs appeared in a recent issue of *United Gas Log*, published by United Gas Pipeline Co., Shreveport, La.

Spearhead of a great national program on *Magic Chef* Ranges

"Mrs. Private Brown—
you rate a better range than that..
...and it's going to be a brand new Magic Chef!"
ONE OF THESE DAYS, you and your husband will be keeping house under much more favorable conditions, Mrs. Brown.
And a brand new, efficient Magic Chef gas range is going to look mighty nice in your kitchen.
Your Magic Chef will be up-to-the-minute in design—of course. It will give you everything you have been wishing for in a range—beauty, convenience, speed, economy. Its cost will be reasonable—and it will give you long years of just the kind of service you want.
Right now we are working to win the war—like you and your husband, and millions of other Americans. But when the "great day" comes and Private Brown is mustered out, we'll be back too, building the Magic Chef again—and building it finer and better than ever before. So keep that name in mind, Mrs. Brown—MAGIC CHEF.
Magic Chef postwar ranges will be available for bottled gas as well as city gas. Ask your dealer about Pyrofax gas for use beyond the gas mains.
One of the American Stove Company plants is now making a gas range in the model permitted by W. P. B. If you are busy in need of a gas range now—ask your dealer or gas company how it may be obtained.
Look for the C.P. seal on your postwar Magic Chef. It assures you of "Certified Performance" in your cooking.
Beautiful, modern Magic Chef ranges similar to this will be ready for you after the war.
Magic Chef
THE RED WHEEL GAS RANGE
WITH THE LIFETIME BURNER GUARANTEE
• SATURDAY EVENING POST
• GOOD HOUSEKEEPING
• WOMAN'S HOME COMPANION
• BETTER HOMES AND GARDENS
Total Circulation
12,573,743
of the kind of people who will buy Magic Chef Gas Ranges

● With this full page color advertisement a great name of a great product makes its reappearance before the American public. The name Magic Chef has stood for the best in gas ranges for many years. This advertisement, appearing in the May 27th SATURDAY EVENING POST, and similar half page color ads in the May issues of other leading national magazines, marks the beginning of a continuing national advertising program to pave the way for future sales and future jobs for thousands of Americans.

This is the first step in a complete and comprehensive program of advertising, promotion and dealer cooperation which will be developed as conditions permit.

For the time being and as long as necessary, the manufacturing facilities of the American Stove Company will be engaged in essential war production.

To take care of urgent requirements a "permitted type" Magic Chef Gas Range is now being produced in limited quantities. For details write your nearest American Stove Company office.

AMERICAN STOVE COMPANY

4901 Perkins Avenue • Cleveland, Ohio

NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO
ST. LOUIS • ATLANTA • LOS ANGELES

Magic Chef

THE RED WHEEL GAS RANGE
WITH THE LIFETIME BURNER GUARANTEE

ASSOCIATIONS

Natural Gas Program Highlights

THe Natural Gas Spring Conference of the American Gas Association will convene Tuesday morning, May 11, with J. French Robinson, AGA vice-president, presiding.

At the first day's session, principal speakers will be Major Alexander Forward, managing director, and Ernest R. Acker, president, respectively, of the American Gas Association.

Other speakers will include R. E. Wertz, past chairman, natural gas section; Mr. Robinson, Dr. R. R. Sayers, director, United States Bureau of Mines, and Dr. Charles E. Lawall, president, West Virginia University.

The Thursday afternoon session will feature a study on the "Purification of Natural Gas with Large Sulphur Content" by C. W. Cooper of Consolidated Natural Gas Co., New York City; Dr. Frank H. Dotterweich of the Texas College of Arts and Industries will discuss "Cycling and its Significance to the Natural Gas Industry."

Another feature of special interest will present Captain E. M. Borger, Peoples Natural Gas Co., Pittsburgh, who has been serving with the American Field Service, and who will speak on "A Gas Man at the Front in Africa and Italy." His address will be illustrated with movies.

The session will also bring another motion picture on the "Internal Cleaning of Pipelines," taken by the United Gas Pipe Line Co., Shreveport.

The remainder of the conference will be devoted to two subjects: 1) "Natural Gas Storage," by Mr. Robinson and, 2) "Long Distance Transmission," by Robert W. Hendee, Colorado Interstate Gas Co., Colorado Springs.

Among the speakers on gas storage at the Friday session will be: Charles F. Turner, The East Ohio Gas Co., Cleveland, who will discuss "Liquefaction of Natural Gas." "Underground Storage" will be discussed by F. H. Finn, The Peoples Natural Gas Co., Pittsburgh; George S. Young, Columbia Engineering Corp., New York City; J. H. Isherwood, North Penn Gas Co., Port Allegany, Pa.; J. R. Reeves, Republic Light, Heat & Power Co., Inc., Buffalo; J. Hawker Newlon, the Equitable Gas Co., Pittsburgh; M. L. Fort, Pacific Lighting Corp., Los Angeles; C. W. Studt, Union Gas System, Inc., Independence, Kan.; W. R. Kubista, Oklahoma Natural Gas Co., Tulsa; Frank D. Howell, Dominion Natural Gas Co., Brantford, Ont.; P. D. Mellon, Canadian Western Natural Gas, Light, Heat & Power Co., Ltd., Calgary, Can.

This subject will be summarized by E. G. Dahlgren, Research and Co-ordinating Committee, Natural Gas Pipeline Co., Chicago; D. K. Stephens, Panhandle Eastern Pipe Line Co., Kansas City; John A. Clark, Hope Natural Gas Co., Clarksburg, W. Va., ("Pipeline"); J. T. Innis, Northern Natural Gas Co., Omaha; G. F. Brunston, Colorado Interstate Gas Co., Colorado Springs ("Compressing Stations"); T. S. Bacon, Lone Star Gas Co., Dallas; H. J. Carson, Northern Natural Gas Co., Omaha ("Dehydration Plants").

Miss Moomaw Advanced

Miss Honoria B. Moomaw, acting secretary of the Natural Gas Department of the American Gas Association, has been advanced to secretary. Miss Moomaw was appointed acting secertary of the Natural Gas Section on June 15, 1942. When the Association reorganization became effective earlier this year and the Section became a Department, she continued as acting secretary.

Distribution Meeting Calls 250 Delegates

WITH a registration of 250, an increase of 50% over the number in attendance at a similar session a year ago, the 21st annual distribution conference of the American Gas Association, held in Cleveland on April 18-19 was by all standards one of the most successful sessions that the Technical Section of the Association has ever sponsored.

A. C. Cherry of Cincinnati, as chairman of the Distribution Committee presided over the two general sessions held in the mornings. Luncheons were divided up into roundtable discussions of topics of specific individual interest, of which there were two each day. On the first day the subject of Pipe Coatings and Corrosion was considered by a group under the chairmanship of R. F. Hadley, Philadelphia, Pa.; and Work on Customers Premises was the topic of a meeting under the leadership of J. M. Pickford of Hammond, Ind. Wednesday luncheons were on Meters and Metering, J. H. Collins, chairman; Construction and Maintenance, H. W. Nicholson, chairman, Newark, N. J.

The meetings were opened by greetings from J. French Robinson, Cleveland, who was present in his dual capacity of vice president of the American Gas Association, and also as president of the East Ohio Gas Co., hosts to the convention. His invitation to those interested to study the operations of the liquefaction plant was accepted by many of the delegates to the conference. About 75 also took advantage of the opportunity to inspect AGA laboratories where the work on domestic gas research is very much in the gas spotlight. Greatest interest, the laboratory personnel noted, was shown in the 100% primary air experiments, and in the single-point flash tube development.

Managing Director Alexander Forward, and President E. R. Acker both conveyed formal messages and greetings of the association, after which the sessions settled down to the consideration of the subjects which had been assigned for treatment.

Every distribution engineer, stated Mr. Forward in his address, appreciates the importance of the appliance situation, since it is through appliances that the enormous responsibility of delivering gas to the homes and business establishments of the nation is accomplished.

During 1944, manufacturers will be permitted to produce 800,000 gas ranges and 88,000 electric ranges, and the allotment of steel and other materials will permit this year's Victory model to be of standard weights.

Hereafter, in accordance with a release already issued, or about to be issued, used hotel and restaurant ranges may be bought and sold freely without restriction, as may new light

cooking appliances not exceeding 50 lbs. in weight.

Just three days prior to the distribution meeting, stated Mr. Forward, the War Production Board made it clearer than ever that civilian production will remain tight until the results of the European invasion become clear. Any possible need by the armed forces comes first, and civilian production is clamped down until the European situation is clarified. All civilian goods' output has been frozen to the maximum of the first quarter of this year in all critical labor areas.

The projected output of 2,000,000 electric irons, heretofore authorized because of their great scarcity in homes, has been cut 90%, and the OPA has put a ceiling on the irons at the March 1942 price—and that is not likely to stimulate production. We cannot expect any other policy for the immediate future.

The recent survey of the gas industry, conducted by the Postwar Planning Committee, shows that more gas companies will merchandise appliances and more will work co-operatively with the dealers to promote sales after the war than before the war, while still others heretofore not selling appliances have not yet reached a decision. This is a most significant fact.

New Water Heater Standards Available at Laboratories

APPROVAL requirements for gas water heaters adopted as American Standards Association on Feb. 23, 1944 are now available in printed form. This is the ninth edition of these requirements and replaces a mimeographed issue previously distributed to interested manufacturers. They are effective as of Jan. 1, 1944.

Principal changes in the construction features incorporated in this edition involve required compliance of various commonly-used accessories with latest American Standard listing requirements for such devices. Gas valves, thermostats and temperature and pressure relief devices constitute outstanding examples.

Bringing the water heater standards in line with performance tests for other types of gas appliances, normal test pressure for use with manufactured gas has been increased to 6 in. In addition, provisions for testing and certification of water heaters for use with mixed gases now being distributed in various territories have also been incorporated.

Other important changes in performance tests are new provisions for testing insulated gas water heaters so that they may be installed flush to walls in modern homes.

Copies of these American Standards may be obtained from the American Gas Association Testing Laboratories, 1032 East 62nd Street, Cleveland 14, Ohio. For additional information, inquiries should be addressed to R. M. Conner, director, at the above address.

Sales Stressed at SGA Meeting

WITH an analysis of the duty and privilege of American sales organizations—large and small—President Frank C. Smith key-noted the wartime conference of the Southern Gas Association which met at Roosevelt Hotel in New Orleans, March 22-23. To quote:

> "It shall become both the duty and privilege of American sales organizations, large and small, to re-employ again following the war numbers equal to the three million employes lost from their ranks due to war conditions. Furthermore, if maximum employment in all fields at that time means 55,000,000 persons must be gainfully employed in this country, an additional 1,750,000 sales people not only can be given employment, but will be absolutely necessary, if goods are to move from factory to market to consumer in proportion to the ability of our productive plant to produce them. Without sales and salesmanship, no matter how high the rate of employment and production, employees will lose their jobs and production will fall flat for lack of market."

The 400 delegates to the two-day session elected Frank S. Kelly, Jr., Arkansas Louisiana Gas Co., Shreveport, president of the Association for the ensuing year.

Mr. Kelly served as vice-president of the organization during the 1943-44 year.

A graduate of Texas A. and M. College, Bryan, Texas, he joined the company in 1926 as an engineer in the gas pipeline department. He was promoted to the position of industrial engineer in the same department on March 1, 1929.

Other officers are: Clayton L. Nairne, New Orleans, New Orleans Public Service Inc., first vice-president; J. H. Warden, Tulsa, Oklahoma Natural Gas Co., second vice-president, and L. L. Baxter, Fayetteville, Ark., Arkansas Western Gas Co., secretary-treasurer.

R. E. Wertz, Amarillo, Tex., was named to the board of directors for a one-year term. Named for a two-year term were Norman Hirchfield, Oklahoma City; W. H. Ligon, Atlanta; J. H. Satterwhite, Tulsa; J. N. Green, Birmingham, Ala.; for a three-year term, W. L. Woodward, Alva., Okla.; D. A. Strickland, Houston; N. H. Oldham, Carlsbad, New Mex.; Sewell Abbott, Dallas.

Speakers at the conference included: A. B. Paterson, president of New Orleans Public Service, "Full Employment in the Postwar Era"; H. Carl Wolf, president of Atlanta Gas Light Co., "Advertising"; Dean Strickland, sales manager of United Gas Corp., Houston, "Appliances for Tomorrow"; Louis P. Ruthenburg, president of Servel, Inc., Evansville, Ind., "Going Forward with Gas," and Col. Willard F. Rockwell, president, Pittsburgh Equitable Meter Co., Pittsburgh, "The Manufacturer Looks to the Future.

Calendar

May

Pennsylvania Gas Association Annual Meeting—Benjamin Franklin Hotel, Philadelphia, Pa., May 2.

Association of Gas Appliance & Equipment Manufacturers—Palmer House, Chicago, May 8-9.

17th National Oil and Gas Power Conference, Oil and Gas Power Division, American Society of Mechanical Engineers —Tulsa, Okla., May 8-10.

AGA Natural Gas Department Spring Meeting — French Lick Springs Hotel, French Lick, Ind., May 11-12-13.

Indiana Gas Association, 1944 Convention—Hotel Lincoln, Indianapolis, Ind., May 15-16.

American Petroleum Institute — Tulsa, Okla.

June

Southwestern Gas Measurement Short Course—University of Oklahoma, June 6-7-8.

AGA Joint Production and Chemical Committee Conference—Hotel Pennsylvania, New York, N. Y., June 6-7.

Public Utilities Advertising Association —Palmer House, Chicago, Ill., June 6-8.

Canadian Gas Association, Annual Meeting—Royal Connaught Hotel, Hamilton, Ont., Canada, June 8.

Natural Gas & Petroleum Association, Annual Convention—General Brock Hotel, Niagara Falls, Ont., June 9.

AGA Conference on the Operation of Public Utility Motor Vehicles—Hotel Bellevue-Stratford Philadelphia, Pa., June 27.

November

American Petroleum Institute—Stevens Hotel, Chicago, Ill., Nov. 13-16.

Texas Daily Wastage Nears Billion Foot Mark

Nearly one billion cu. ft. of gas, equal in fuel value to approximately 166,667 barrels of crude oil is being wasted every day in Texas, according to figures at the Texas Railroad Commission oil and gas division. Latest reports show this much casinghead gas, produced with oil, is being popped daily for lack of any better use or method of handling it.

With the production of nearly 2,000,000 barrels of oil daily in Texas there are 2,639,614,000 cu. ft. of casinghead gas. Of this amount, 1,650,998,000 ft. goes into plants for extraction of natural gasoline for gas lifting on oil wells, for repressuring oil fields, for domestic fuel or other useful purposes. That leaves 988,616,000 ft. to be burned daily.

Research and Co-ordinating Committee, Interstate Oil Compact Commission. SEATED, left to right: Lloyd Jordan, El Dorado, Ark.; Samuel F. Peterson, Springfield, Ill.; Samuel Yuster, State College, Pa.; L. B. Taylor, Wichita, Kan.; E. G. Dahlgren, Oklahoma City; Miss Peyton, New Orleans; Harry Bell, Baton Rouge. STANDING, left to right: Glenn Staley, Hobbs, N. Mex.; Lawrence Alley, Oklahoma City; Walker T. Pound, Oklahoma City; John Kelly, Santa Fe, N. Mex.; J. B. Wilson, Oklahoma City.

Return of States' Rights Asked at IOCC Meeting

By O. D. HALL

GAS Staff Correspondent

THE Research and Coordinating Committee of the Interstate Oil Compact Commission, at its spring meeting in New Orleans, La., April 3 and 4, voted to resurvey the disposition of dry and casinghead gas. "A survey of this nature was made in 1942 but it was felt that the data should be brought up to date with a view of using the information to further the elimination of avoidable waste of natural gas and to encourage the utilization of gas for superior purposes," the Committee reported. L. B. Taylor of Kansas is chairman, S. T. Yuster, of Pennsylvania, is vice chairman and E. G. Dahlgren, of Oklahoma, is technical secretary of the Committee.

Resolutions adopted by the Commission recommended that the Petroleum Administration for War, "Immediately revise and cancel, where possible, all PAW activities and regulations not vitally essentail to the war effort." They also recommended that, "Without limitation in this respect, all PAW restrictions and regulations relating to the spacing, drilling and production of oil and gas be revised and cancelled, where possible to the end that only such minimum PAW regulations be retained as to satisfy essential WPB requirements in respect to the allocation and allotment of restricted materials."

Other resolutions recommended that each oil and gas producing state whether a member of the Interstate Oil Compact Commission or not, enact more efficient conservation laws, rules and regulations in states having conservation laws, and that states now having no such regulation, should adopt new conservation laws. Such action would, "best insure the return to the sovereign states of that power justly belonging to them to regulate the production of this great natural resource."

Another resolution adopted by the Commission declared that: "In order to insure the discovery of adequate oil reserves it is necessary that the price of crude oil be reasonably increased." A subsidy in any form will not solve the problems confronting the oil industry and, "will be inadequate and ineffective to promote additional discoveries of oil and gas."

Schoeppel Keynotes Meeting

Governor Andrew F. Schoeppel, chairman of the IOCC, in his response to the address of welcome declared that, "When war is over the individual states are going to expect to have control of their important natural resources—oil and gas—returned to them. We do not propose to accept excuses nor tolerate delays. We have a right to demand return of powers, but we have an obligation to properly use those powers when they are returned to us. States that have conservation laws should take careful inventories of their situation. States that have none should lose no time in setting up proper machinery.

"The war period has heightened the interest of public officials in several producing states from which it is proposed to export natural gas through interstate pipe lines," said Commissioner John W. Scott, Federal Power Commission. "Depletion of certain older gas fields in the Appalachian and other areas, has resulted in filing with the FPC a large number of applications for certificates of convenience and necessity for operation of interstate pipeline facilities to meet present war and essential civilian needs. In practically all of the certificate proceedings representatives of both management and labor, the coal, railroad and related industries have intervened in protest against construction of new lines. Their contention is that rapid expansion of marketing of natural gas will result in displacing fuels whose reserves are not so limited and will create economic maladjustment, unemployment and other hardships in industries already supplying the markets. They also contend that natural gas is a luxury fuel and should be conserved for domestic and commercial consumers."

Commissioner Scott stated that it is not the purpose of the FPC to destroy the business of natural gas companies subject to its jurisdiction. He declared that it is the purpose of the commission to treat the natural gas and competing fuel industries fairly and without discrimination. He suggested a conference between the representatives of the Interstate Oil Compact Commission and the Federal Power Commission for studying common problems related to utilization and conservation of natural gas.

A review of cycling in Louisiana was given by R. L. Keyes, assistant division manager, Texas Co., New Orleans, La. "Cycling is playing an important role in the war effort by furnishing raw products for 100 octane aviation gasoline and synthetic rubber," he said. The first cycling plant was built in Texas in 1938. During 1943 four cycling plants in Louisiana processed 92,200 million cu. ft. of gas, recovered 4,503,575 barrels of liquid products and returned 64,400 million cu. ft. of residue gas to the reservoirs. These plants are currently processing 260 million cu. ft., of gas and extracting 13,000 barrels of products per day. Louisiana has heavy gas-condensate reserves and many offer good prospects for cycling operations. Several additional cycling plants for that state are projected, Mr. Keyes reported.

The Interstate Oil Compact Commission's public lands committee, Warwick Downing of Colorado, Chairman, expressed the opinion in its report that the committee should be

empowered to present to the Maloney committee of the U. S. Senate, "a statement showing the manner in which the development of public lands has been retarded by Interior Department policies," and making recommendations for measures which will increase our national supply of oil and gas.

Committee Findings

The committee found that the federal government is rapidly acquiring for many purposes, "an astounding amount of new public lands" subject to reservations to the United States of not less than an undivided three-quarters of the coal, oil, gas and other minerals in and under the properties. The committee expressed the belief that this policy is highly detrimental to the public welfare because it makes the federal government a "proprietor in business property" and vests control of a divided interest in minerals in a public agency at Washington which will "retard and probably prevent the development of the oil and gas resources of the several states."

The committee on Regulatory Practices recommended a proposed new rule for dual completions and that the dual completion of any well be permitted only after application and hearing.

Major B. A. Hardy, of Shreveport, La., representing the Independent Petroleum Association of America, told the meeting that the states can use the Interstate Oil Compact Commission as a means of assuring themselves of their right to control and regulate their own minerals. Frank Bane, executive director of the Council of State Governments, Chicago, commended the Compact Commission's conservation program as a blow to unemployment after the war.

Registration at the meeting reached 400. More than 600 people saw the premiere of "Oil for Tomorrow," the technicolor moving picture prepared under the direction of Charles Orr, secretary of the Interstate Oil Compact Commission.

Wisconsin Ass'n Nominees

S. B. Sherman, vice-president and general manager, Wisconsin Gas & Electric Co., Racine, last month was nominated for president of the Wisconsin Utilities Association for the fiscal year beginning May 1.

Vice-presidential nominee is M. H. Montross, Wausau division, Wisconsin Public Service Corp., Wausau; treasurer, Alfred Gruhl, assistant research engineer, Wisconsin Electric Power Co., Milwaukee.

FRONT ROW (left to right): H. M. Henry, Cambridge, incoming president; N. B. Bertolette, Hartford, retiring president; D. S. Reynolds, Boston, first vice-president. BACK ROW (left to right): E. H. Eacker, Boston, treasurer; Clark Belden, Boston, executive secretary-clerk; L. E. Knowlton, Providence, second vice-president.

H. M. Henry to Lead Nega in 1944-45

The New England Gas Association elected the following officers and directors at the 18th Annual Business Conference at Hotel Statler, Boston, on March 23.

OFFICERS

President—H. M. Henry, director of gas operations, Negea Service Corp., Cambridge; *1st Vice President*—D. S. Reynolds, vice president and chief engineer, Boston Consolidated Gas Co.; *2nd Vice President*—L. E. Knowlton, engineer, Providence Gas Co.; *Treasurer*—E. H. Eacker, vice president, Boston Consolidated Gas Co.; *Clerk*—Clark Belden, executive secretary, The New England Gas Ass'n., Boston.

ELECTIVE DIRECTORS

Directors-at-large—J. A. Cook, general manager, Lynn Gas & Electric Co.; G. R. Copeland, regional representative, Servel, Inc., Boston; E. M. Farnsworth, president, Boston Consolidated Gas Co.; E. L. Hall, manager, Manchester Gas Co.; A. V. S. Lindsley, vice president in charge of sales, The Connecticut Light & Power Co., Waterbury; I. L. Moore, president, New England Power Assn., Boston; A. G. Neal, manager, Fitchburg Gas & Electric Light Co.; E. F. Putnam, president and general manager, The Greenwich Gas Co.; R. E. Ramsay, president, New Haven Gas Light Co.; P. J. Rempe, vice president, Stone and Webster Service Corp., Boston; J. J. Scott, general manager, Lewiston Gas Light Co.; E. G. Twohey, manager Northampton Gas Light Co.; J. L. Underhill, president and general manager, North Attleboro Gas Co.; A. M. Wolfe, manager, Nathaniel Tufts Meter Works, Boston.

10 EX-OFFICIO DIRECTORS

Five Most Recent Past Presidents—(1943-44) N. B. Bertolette, persident, The Hartford Gas Co.; (1942-43) John West, president, Worcester County Electric Co.; (1941-42) C. G. Young, manager, Springfield Gas Light Co.; (1940-41) J. A. Weiser, president and general manager, The Newport Gas Light Co.; (1939-40) R. J. Rutherford, vice president, Worcester Gas Light Co.

The following men, as next year's division chairmen, are Association directors, having just been elected by the members of their respective divisions:

Five Division Chairmen—Accounting—J. C. Stewart, Blackstone Valley Gas & Electric Co., Paw.; *Industrial*—A. J. Huston, industrial sales engineer, Worcester Gas Light Co.; *Manufacturers*—G. P. Velte, regional representative, American Stove Co., Boston; *Operating*—F. H. Faulstich, assistant to the manager, Springfield Gas Light Co.; *Sales*—H. V. Potter, sales manager, Fall River Gas Works Co.

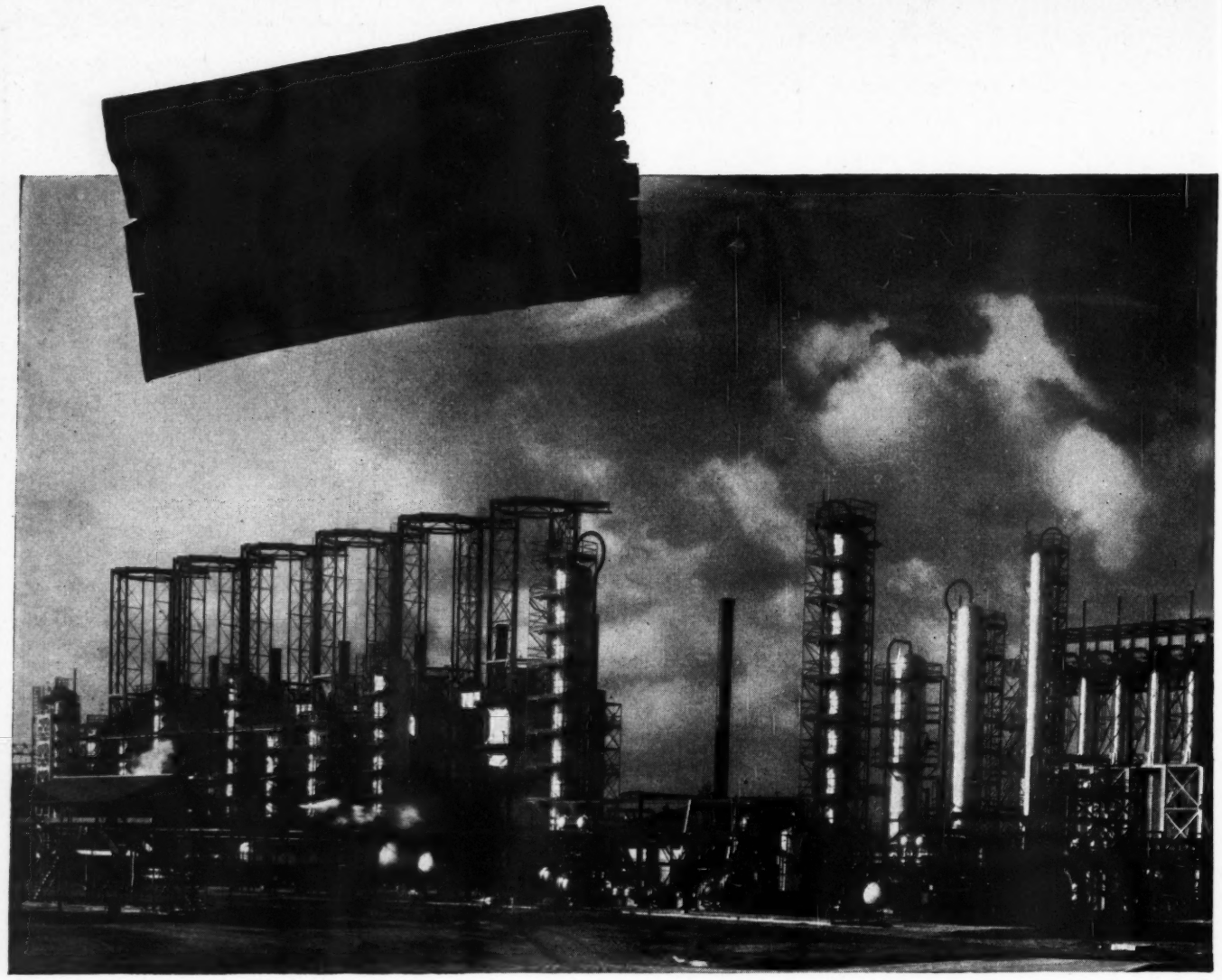
HOME SERVICE GROUP

The Home Service Group elected the following officers for the coming year:

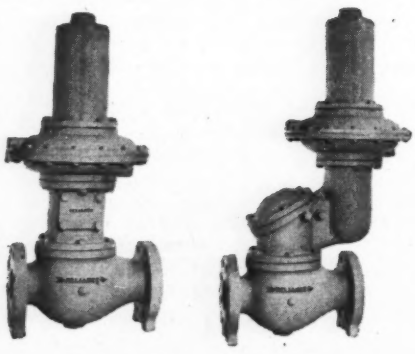
Chairman—Hazel Cheever, home service director, Malden & Melrose Gas Light Co.

Vice Chairman — Florence Mooney, home service director, Lynn Gas and Electric Co.

Secretary—Susan Mack, home service director, Boston Consolidated Gas Co.



in gasoline production means Reliance



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Notes From the Wartime Conference On
INDUSTRIAL AND COMMERCIAL GAS

RESOLVING to conduct a militant campaign for industrial and commercial gas in the postwar period, 300 delegates to the 1944 AGA War Conference on Industrial and Commercial Gas gathered in Rochester, N. Y. on March 30-31, from all parts of the country to discuss ways and means of bettering their service and combatting the inroads of competition from other fuels.

The meetings were conducted by Charles G. Young, chairman, and Harry K. Wrench, vice-chairman of the section. There were presented a number of papers covering such subjects as air conditioning, heat treating, rebuilding of personnel, reconversion problems, and discussions of the new services which industrial gas will be able to form in the future.

Excerpts from a number of the papers presented follow:

PRESENTED on these pages are abstracts of some of the papers presented at the AGA 1944 War Conference on Industrial and Commercial Gas, Rochester, N. Y., March 1944.

Gas Uses on the Industrial Material of Tomorrow

LAWRENCE E. BIEMILLER, assistant manager, industrial fuel department, Consolidated Gas Electric Light & Power Co., Baltimore.

Steel: Steel will be one of the important industrial materials of tomorrow. All trends in recent years have been toward an increasing market for gas in connection with the production and fabrication of steels. Particularly in the various heat treating operations the trend has been toward furnaces which require a flexible fuel most readily controlled to yield the desired temperature, heat distribution, and atmosphere. Gas is constantly improving its competitive position and increasing its market as the preferred fuel for the steel industry.

Plastics: Due to the low temperatures at which most of the plastics can be shaped, up until this time steam has been the main source of heat in the plastics industry. With the trend toward higher temperature plastics, the future promises the use of direct gas heat.

Plywood: Several types of adhesives are used for forming plywood, either with or without heat, but always under great pressure. Up to this time where heat has been used it is used at a relatively low temperature such that steam has been satisfactory. To date most of the use of gas in conjunction with the manufacture of plywood has been in generating this steam.

Gas may have other uses in connection with some new plywoods. For example, there is now a plywood which is surfaced with a metal such as aluminum, monel metal or stainless steel. It is used where metal surface is required and where the plywood gives desired added strength. There are possibilities of the use of gas fuel in connection with the heat treating or surface covering of the metal in such a combination.

At the present time it is thought that electricity will play an important part in the plywood industry through the use of electronic or high frequency current to permit adequate heat penetration under improved temperature and time control. When an industry becomes interested in the ability to perform heating operations under such conditions, then it becomes a prospect for the use of gas for heat in the near or more distant future.

Furnace Mechanism: Perhaps the most outstanding development of recent years in connection with industrial heating has been the improvement in furnace mechanisms, robot controls, automatic charging, synchronized door operation, and speedy and automatic quenching. The greater the trend toward such furnace controls, the larger the field for the application of a controlled fuel like gas.

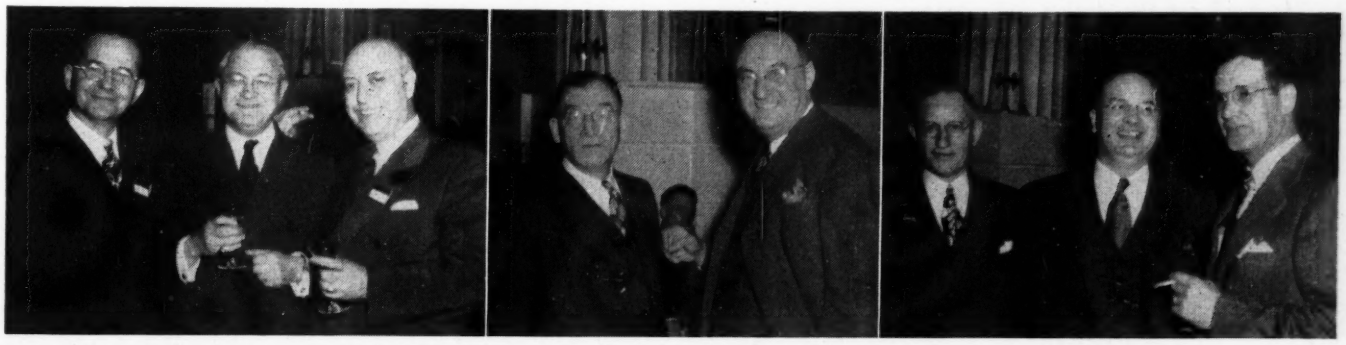
Reconversion Problems

KARL EMMERLING, assistant general superintendent, The East Ohio Gas Co., Cleveland, and J. P. Leinroth, general industrial fuel representative, Public Service Electric & Gas Co., Newark.

Before any reconversion problem can be approached, it is necessary to know:

1. What idle furnace equipment is available in our customers' plants, what sort of shape it is in, what fuel it is designed for, and if it is complete, or if it has been robbed for repair parts.

2. What furnace equipment is now in use, what it is being used for, its fuel, its conditions, and whether or not it can



AT LEFT (left to right): **C. B. Phillips,** Surface Combustion, Toledo; **J. P. Leinroth,** Public Service Electric & Gas Co., Newark; **Eugene D. Milener,** American Gas Association, New York City. **CENTER** (left to right): **Nelson R. Gorsuch,** Citizens Gas & Coke Utility, Indianapolis; **C. M. Sieger,** United Gas & Fuel Co., of Hamilton, Ltd., Hamilton, Ont. **AT RIGHT** (left to right): **J. B. Wynne,** Detroit-Michigan Stove Co., Detroit; **Harry J. Holbrook,** chief appliance branch, plumbing and heating division, War Production Board Washington, D. C.; **J. R. Delaney,** Cincinnati Gas & Electric Co., Cincinnati.

Five Stepping-Stones to Industrial Gas Opportunity

FREDERIC O. HESS, president, Selas Co., Philadelphia, Pa. Excerpts from an address, "Look Out for Industrial Gas," presented before the New England Gas Association Annual Meeting, Boston, Mass., March 23.

THE future of industrial gas offers an unusual opportunity, enhanced by the immense production requirements and process developments during this war. In order to justify this optimism the gas industry must resolve to take advantage of its opportunity; must conscientiously absolve its obligation. The approach to this industrial gas opportunity must be appropriate and aggressive, supported by the management, and embracing several definite steps:

1. Industrial sales engineers must acquire a thorough understanding of heat engineering and must treat gas more as a process medium than as a mere fuel.

2. Sales engineers and their superiors must remain in intimate contact with industry in general, and with gas equipment manufacturers in particular. There is a vast cooperative development program ahead to explore and ultilize combustion. Intense research will be required to understand and exploit the wide unused spread between but two descriptive words of combustion—the gas flame and the explosion.

3. Technological advances, such as outlined before, take place so rapidly that only intimate and frequent contacts afford an opportunity to keep ahead of developments. This also necessitates taking part in technical meetings, such as regularly arranged in various parts of the country by the different technical societies.

It is of course understood that not all industrial gas sales require engineering. There will be torches and other plain, simple heating jobs. But such application will not be a major factor—will definitely not safeguard and expand industrial gas use in the major manufacturing fields, in the processing industries.

4. Therefore an effective sales policy must last, but not least, call for the selection of high calibre men as industrial gas representatives, capable of discussing industrial processes and the function of gas as a process tool. They must have engineering and combustion knowledge rather than be carriers of rate schedules or catalogues.

5. Such an aggressive sales policy to be successful must also include and rely on engineered gas equipment. Equipment manufacturers have in the past and will in the future, exert efforts to furnish and develop such equipment, but they in turn require cooperation by the gas companies; cooperation and support which appreciates the necessity for equipment and development — cooperation which gives recognition to the fact that the lowest cost equipment often is not the best equipment for the customer and ultimate user, the same as the lowest cost fuel on a cubic foot or gallon basis is not decisive — but the results, the performance and ultimately the cost per finished product.

readily be converted to gas, if using a fuel other than gas.

3. The condition of the gas distribution system in the plant, and what will be necessary to put it into shape for peacetime operation, when economy will again mean something.

There are many places where opportunities of obtaining more load exist.

The steel plants still use large quantities of producer gas and fuel oil, much of which can be replaced if the equipment using this fuel is redesigned and rebuilt for natural gas firing. Included are soaking pits, continuous heating furnaces, large heat treating furnaces, etc.

One of the really large sources of potential business for natural gas is the hundreds of open hearth furnaces in use in the steel industry. Natural gas has never made too much headway here, and it is felt that in properly designed furnaces gas can successfully compete with fuel oil, both in cost and speed. The latter has always been a stumbling block to natural gas. A nationwide survey of methods of utilizing natural gas in open hearth furnaces is well worthy of consideration by the natural gas industry. From such a survey, one might be able to develop a method of using natural gas that would really compete with oil. A survey of this type might be undertaken in cooperation with the open hearth section of the American Institute of Mining and Metallurgical Engineers.

The heavy ceramic industry, including the brick and tile, the glass, and the cement industries, should still furnish ample opportunity for expanding the natural gas load.

In many areas, where coal and oil are relatively high in cost, power boilers will present an attractive possibility for adding load, particularly if a dump gas arrangement can be worked out.

The list of opportunities for extending our load after the war is endless and could be extended indefinitely. What these opportunities are must be determined.

It is not too early to make definite postwar sales plans. Perhaps changes will have to be made in them as time goes on, but we should know today definitely what we would do if the war ended next month. Industrial and commercial departments should have an allocation of man power based upon studies of our projected postwar customers and markets, and a plan for sales policies and methods. How about manufacturers and dealer cooperation and what advertising are we going to do? These things not only should be clear now, but should be down on paper with management's approval as well. There is no rule against reviewing these plans from time to time and revising them. But don't have the war stop and be caught unprepared.

What Colleges Think of Gas Equipment

ROBERT C. LeMAY, industrial engineer, The Connecticut Light & Power Co., Waterbury, Conn.

A survey has presented a fairly clear picture of the conditions which exist in sixteen representative schools and colleges. No effort was made to select progressive or non-progressive institutions, or to influence the picture in any way.

The information summarized below has been taken from the tabulated data on more than 100 pieces of high temperature equipment. This includes chiefly furnaces used for metal heat treating, melting and forging, although enough information was received on low temperature units to enable us to comment on them as well. These latter appliances include steam boilers, ovens, torches, tank heaters and special burner applications, as well as the usual bunsen burners and hot plates.

1. Gas and electric equipment predominate, with coal firing used for special heat applications. No oil fired furnaces were reported.

2. The average age of the gas furnaces is 16 years. The average age of the electric furnaces is 8 years. Even more significant is the mean age figure. The mean age of the gas furnace is 18 years, and of the electric furnaces, 5 years. This indicates that for every new gas furnace there is one about 30 years old, and for every gas furnace five years old there is one about 25 years old, and so on.

3. While the majority of electric heat treating furnaces have automatic temperature control, few gas furnaces are so equipped.

4. Most of the gas furnaces are without insulating refractory linings and without automatic air and gas proportioning devices for combustion control.

5. A small proportion of the furnaces are homemade, both gas and electric. The oil drum seems to be a favorite type of furnace shell in these cases.

6. Only two gas-fired furnaces have any semblance of separate atmosphere control, and these employ diamond blocks. The electric tool hardening furnaces include

How Natural Gas *Helps* Conserve Oil for War Use

Pacific Gas and Electric Company is now burning natural gas fuel instead of oil in its steam electric plants—to make available over 10,000,000 barrels of oil a year needed by the armed forces and war industries.

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almost every type now sold, and some of these are equipped with external atmosphere generators.

7. Fewer than 25% of the gas furnaces are satisfactory modern units. Because of this fact, it was definitely established that it is usually the electric furnaces which are employed where both types are available.

8. Low temperature gas equipment is generally more modern, is in somewhat better condition than the gas hardening room equipment, and is better liked. There seems to be a desire, however, for something more modern and better looking in the way of gas-fired hot plates.

The Engineers' Council for Professional Development in 1942 listed 31 American colleges and engineering schools with approved metallurgical courses. A plan to place modern gas fired equipment in these schools should be within our ability to execute, and should result in a generation of metallurgists who will be invaluable to us, because of their assistance in future industrial gas sales. Obviously, to replace all unsatisfactory gas-fired equipment in all of these institutions would be too ambitious a project, but it should be possible to install in nearly every one of these schools enough of the best gas-fired equipment to permit gas fuel and equipment to create favorable impressions.

Trends in Prepared Foods

CLARENCE BIRDSEYE, Gloucester, Mass.

Very few people realize the tremendous size and potentialities of the perishable food business. Exact statistics are lacking, but apparently food consumption in the United States was approximately fifteen billion dollars in 1932 and twenty-one billion dollars in 1942. The projected figure for 1946 is truly staggering—thirty-four billion dollars! On the average, perishables represent about 75% of total food consumption in the United States; so that sales of perishable foods alone were about ten billion dollars in 1932, fifteen billion in 1940, and may be expected to reach twenty-four billion by 1946.

In 1939 the food-processing industry was about 10% larger in dollars invested, people employed, and volume of sales than any other two industries combined — e.g., rails and steel. Surely such an industry merits the most careful attention from the commercial departments of practically every form of American utility.

The postwar world will see a much larger proportion of our foods distributed in the form of canned, quick-frozen, and dehydrated products. The field for such products is enormous. Possibilities for increased use of gas exist in the processing, distribution, cold storage, and cooking of all such foods. It should pay the gas industry well to study these possibilities very carefully.

C. A. Bland Named President Of Mid-West Association

The thirty-ninth annual meeting of the Mid-West Gas Association was held on April 5 at Des Moines. The following officers were elected:

C. A. Bland

President, C. A. Bland, superintendent of gas production, Iowa Power and Light Co., Des Moines; first vice-president, B. R. Bay, president, Northern Natural Gas Co., Omaha; second vice-president, E. Clark Deane, Central Electric & Telephone Co., Sioux Falls; secretary-treasurer, R. B. Searing, Sioux City Gas and Electric Co., Sioux City.

AGA Managing Director Alexander Forward was the principal speaker at the meeting. At a session of the executive council a resolution was passed urging WPB to modify orders L-23-c and M-9-c to permit the installation of oven heat control equipment on all new gas ranges manufactured.

Measurement Course Plans June Meeting

While traveling difficulties, due to the war, may reduce attendance at the Southwestern Gas Measurement Short Course at Norman, Okla., June 6, 7 and 8, this year, an insistent demand exists for the course, W. H. Carson, dean, College of Engineering, University of Oklahoma, says.

The general committee met in Oklahoma City recently to elect new members and to transact other business. Max K. Watson, general chairman, presided. New members elected to the committee included: George E. Greiner, Phillips Petroleum Co., Bartlesville, Okla., to replace G. W. McCullough, ex-officio member; B. F. Worley, United Gas Corp., Houston, Texas, succeeding R. J. Sullivan, resigned; Lloyd L. Jordan, to represent the Arkansas Oil and Gas Commission, and L. B. Taylor, to represent the Kansas Corporation Commission.

Production Award

• **Williams Brothers Corp.,** pipeline construction contractor, has had conferred upon it the first Navy Department award in the Canal Zone for outstanding civilian achievement in the prosecution of the war. Because of military secrecy, details of the award are withheld.

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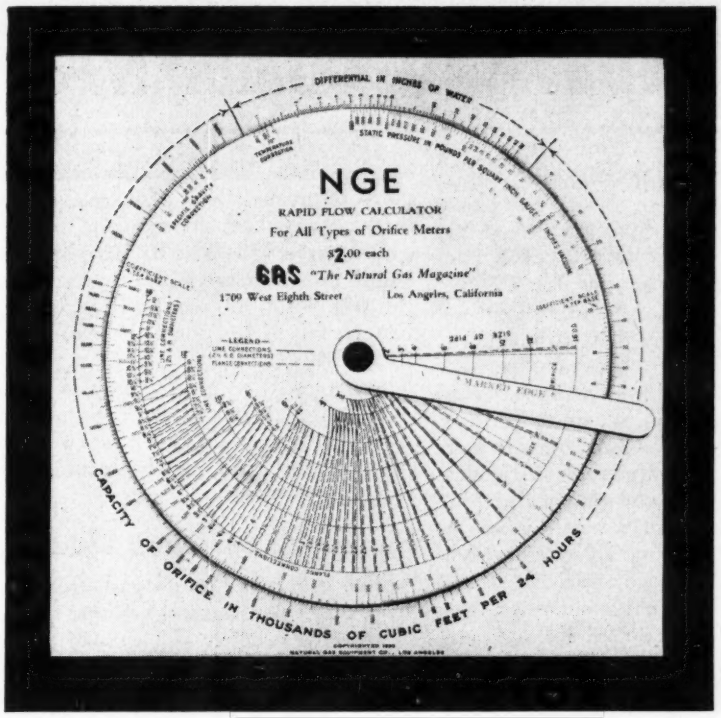
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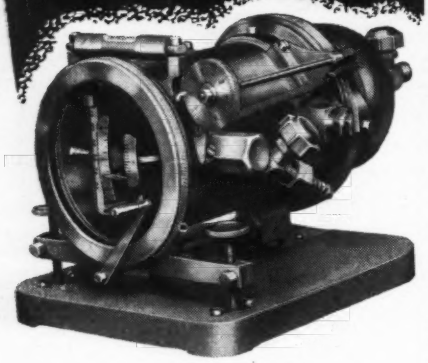
ADDRESS_____

FIELD MEASUREMENTS of Specific Gravity of Gas with LABORATORY ACCURACY



ARCCO-ANUBIS
Portable
GAS
BALANCE

PRECISION BUILT IN ARCCO LABORATORIES

Ruggedly constructed. Completely self-contained. No accessories required.

LIGHT

Only 20 pounds complete in carrying case.

NO TINKERING

Easy to operate and easy to read. STAYS accurate in hardest field service.

HUNDREDS IN USE BY MAJOR COMPANIES

Send for Bulletin No. 101

American
RECORDING CHART CO.
3113 E. 11th St.,
Los Angeles 23, California

TRENDS AND COMMENT

Post-War Purchasing

We have read here and there of the different schemes which plotting sales managers have concocted to get our money away from us now, usually in the form of war bonds, to make certain that we will buy their products in the coming Golden Age of Post-war Production. We have resisted even thinking about such schemes, preferring to keep our own war bonds in our own vaults. No entangling alliances for us. That new and wonderful gas range you talk about, we want to see it before we put our money on the line.

In taking this uncooperative attitude we recognize that a little money systematically put aside now will be good for the individual and the country in days ahead. Therefore we would like to comment briefly on "The Purchase Club," which, according to the Dec. 15 issue of *Tide*, is now in operation at the Franklin Square (Long Island) National Bank. Arthur T. Roth, a vice president of the bank, is the originator of the plan.

This plan, which is so simple anyone can easily grasp it, will, if properly adopted, predicts Mr. Roth, create employment for more than 20,000,000 workers for three and a half years after the war.

The plan goes into operation when a consumer confesses his intention to buy a new gas range after the war. The bank starts him saving either for the down payment or for the full price by laying aside a specified amount in each of 50 weeks. The future consumer, a member of the Purchase Club, receives a coupon booklet for his weekly payments, and gets 2% interest on his money. He may close the account or change his plan without penalty.

Mr. Roth's club has already gathered hundreds of members, and he figures that if each of 15,000 banks opened 1500 accounts of $300 each, some $4,500,000,000 would be accumulated, all earmarked for consumer goods. Most members are saving for radios, new homes, washing machines.

The plan appears to be catching on, and requests for information have come in from more than 500 banks in 32 states. At the present time 86 banks are using the plan. One manufacturer would like to have the rights to the plan for distribution as a public service to the banks and to his 22,000 dealers.

Mr. Roth states that the plan does not compete with the purchase of war bonds, since Purchase Clubbers are more interested in a little ready cash than in long-term savings.

We agree with Mr. Roth. The plan would not interfere with our war bond program and we would like nothing better than to lay aside the dough for that 1942 Cadillac, which our wife hopes we will be able to buy in 1946. We would do it, too, except the plan does compete with that other Federal activity, the Tri-Monthly Income Tax Guessing Contest.

Employee Morale Building

The diorama has proved itself one of the best ways to tell a story.

Western Electric Co. wanted to put across to its 90,000 employees the importance of their work in the war effort. Accordingly the labor-management war production committee of the Kearney, N. J., works went to work, discussed all the usual approaches—advertising, plant posters, plant rallies, booklets, etc.—and then because of its dramatic combination of sight and sound chose the diorama.

The presentation, probably the most elaborate employee morale building project in industry, consists of three giant dioramas called "War Communicade." Each is 60 ft. long and nearly 15 ft. high, representing in three dimensional form reproductions of land and sea battles in which Western Electric equipment plays a vital role.

The Diorama Corp. of America, New York, in building the display, has achieved realism by stressing minute detail and by using electric installations which permit vivid representation of a city lighted up at night, searchlights, planes moving across the sky, bombs exploding, gun flashes, moving tanks, etc. The action is described as it takes place in the language of the fighters who have participated in the land and sea battles.

The three scenes depicted are (1) a portrayal of home front protection facilities during a possible air raid; (2) a naval battle; (3) a land battle showing use of all war communication systems, including tank radios.

The "War Communicade" has been extremely well received by employees, according to F. B. Shannon, chief of the public relations division of the Kearney works and chairman of the show committee which planned the exhibit.

The gas industry, too, has a war story to tell.

Post-war Notes and Notions

By STANLEY JENKS

Distribution

And now it is unanimous. By stressing the vital importance of rebuilding our distributing machinery as a prime factor in successful gas appliance marketing, once the bars are down again, the AGA Post-war Committee in its Information Bulletin No. 1, has rung the bell in no uncertain terms. The appliance and equipment manufacturers have known all along that distribution is their most pressing post-war problem.

The U. S. Bureau of Commerce states that 300,000 retailers have gone out of business in the 1941-1943 period. This, if nothing else, indicates the terrific scramble there will be for outlets when the war ends. The more complacent of our merchandising brethren—the lads who traditionally didn't like dealers anyway and who felt that they and they alone were competent to sell gas appliances—might say "Good riddance." Let's hope such short-sightedness will be rare, because while, admittedly, there were incompetent dealers, we are not discussing individuals, but a fundamental post-war policy. In a nutshell, this is the question: the gas company versus the field (oil, coal and electricity); or the gas company plus the field for all the load that can be had.

What makes a good dealer? First and foremost is an attractive profit. If the gas company can help the dealer to make a satisfactory profit on gas appliance sales, the first hurdle has been cleared. What makes a good cooperative dealer? Again, it is emphasized on this page that your average appliance dealer is a rugged individualist, and inclined to be allergic to the straitjacket into which some of our alleged pre-war cooperative policies laced him. He wants to deal directly with his manufacturer or distributor and they want to deal directly with him. And why not, so long as the appliance meets quality requirements?

In appraising any local situation, it will be as well to remember there will be no neutrals in the post-war battle of the fuels. Those dealers who are not for us will be against us. As allies, they will be mercenary—profits or else!—and they will not and never will be load-minded. They will be independent appliance dealers and not subsidized minions of ours or any other utility. We should encourage their independence, for from it will arise that mutual respect, which is the first of all in-Powers Model.

Tomorrow's Homemaker

Who? Pretty, curvacious, and with all the specs of a Powers Model. As she floats

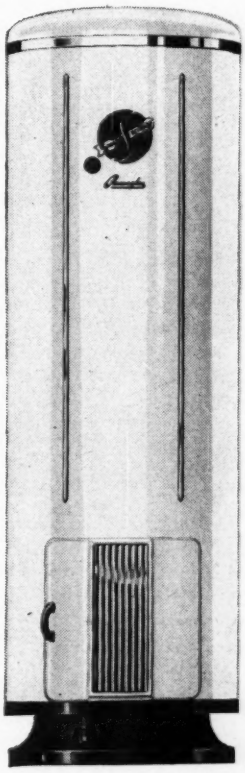
Maybe you saw her. She's tomorrow's helpmate (AGA version) in the April 15 issue of the *Satevepost.*

I print this because a lady whose acumen and judgment I respect considerably, when asked for her frank comment on the advertisement, said that apparently some people felt all women were bobby-socked Sinatra fans.

Chances are, you'd choose the crystal clear glass tumbler because you *know* that glass is *clean* and *sanitary. You* know it — and *your customers* know it.

And *that's important* in your home appliance market, where new and higher standards of perfection in hot water cleanliness and sanitation will be demanded.

SMITHway *Permaglas* Automatic Gas Water Heaters will *meet that demand* . . .



The tanks are lined with glass — *Permaglas* — a smooth, lustrous, blue glass lining, permanently fused to the inside of every SMITHway Steel Tank.

Permaglas will be your opportunity to sell quality—*profitably.* It will be your assurance of sales volume in a large market that will insist upon *modern methods* in hot water convenience, cleanliness, and sanitation.

Now is the time to know all about the inside story of SMITHway *Permaglas* Automatic Gas Water Heaters. Write for complete information.

"Heated with Gas— Stored in Glass"

Permaglas Victory Model Heaters are available in all sizes in accordance with WPB limitation order L-185.

SMITHway Permaglas GLASS LINED
GAS WATER HEATERS

Buy More War Bonds

Offices at: New York, Pittsburgh, Chicago, Tulsa, Houston, Los Angeles, Seattle
In Canada: JOHN INGLIS CO., LIMITED

A. O. SMITH Corporation
Milwaukee, Wisconsin

WAR ADVERTISING

☆

A FACTUAL REPORT

The P. C. G. A. Cooperative Advertising Committee, like individual gas companies, has converted much of its space to support of the war effort.

During the past 23 months, 20 domestic advertisements (full pages in color) have featured war subjects, with 12, or 60 per cent, of these devoted almost wholly to such government-favored projects as War Bonds, fuel conservation, Red Cross, nutrition and care of appliances.

Of the 89 advertisements—domestic and trade journal—published by the Committee during this period, 24 featured war projects, and 32 included War Bond or other war-supporting messages.

THE PACIFIC COAST GAS ASSOCIATION

GAS FUEL

☆

SERVING THE WEST IN WAR AND PEACE

PEOPLE

• **Fred M. Graham,** Calgary, was appointed president of the Alberta Petroleum Association at a meeting of the directors in Calgary in early April. He will fill the unexpired term resulting from the death in March of **B. L. Thorne,** Calgary. Mr. Graham has been actively connected with the Alberta oil and natural gas industry since 1914 and had been vice president of the association since its founding in 1938. He is director of a number of oil companies as well as president of Sunset Oils Ltd. **Francis F. Reeve,** Calgary, was appointed vice presisident to succeed Mr. Graham.

• **John Keillor,** head of the gas department of B. C. Electric Railway Co., at Vancouver, B. C., for 28 years, will retire in May, to be succeeded by **E. H. Rohrer,** Montreal Coke Manufacturing Co.

Former president of the Canadian Gas Association, Mr. Keillor has been 50 years in that business. After 12 years in Scotland, and 10 in Hamilton, Ont., he came to Vancouver in 1916. He has watched Vancouver gas consumption rise from 200 to 2000 million cu. ft. annually. There have been five major changes in the plant, culminating in recent erection of the present plant.

• **Fred Heimerdinger** has been promoted from foreman in the Kansas City Gas Co.'s installation and service department to superintendent of the department, and **Paul Ford** was named manager of The Gas Service Co.'s Independence, Mo., property.

• **Frank H. Fischer,** test engineer with the American Gas Association Cleveland Testing Laboratories, has resigned to accept a position as a development engineer with the Dearborn Stove Co., Chicago, manufacturers of space heaters. Mr. Fischer entered the Laboratories' employ in 1939 following his graduation from Ohio State University as an electrical engineer.

E. M. Borger

Captain Edward M. Borger, American Field Service, has returned to Pittsburgh and the presidency of The Peoples Natural Gas Co. after a year of front line duty in Egypt Tunisia and Italy.

Mr. Borger left the United States Nov. 23, 1942, in charge of a detail of 100 American ambulance men and was in service for 16 months, going first to Syria and then joining the British Eighth Army in Libya and Tunisia. He was engaged in forward ambulance work with the New Zealanders when they flanked the Mareth line and broke the German front. He was in Italy when relieved.

• **R. L. Hayden,** manager of Contra Costa Division of Coast Counties Gas and Electric Co., Santa Cruz, Calif., has been appointed sales manager in charge of all gas and electric sales activity.

R. L. Hayden

This appointment will relieve **H. W. Edmund** of sales responsibility which he carried on for the past year and a half in addition to his duties as vice president and general manager. Mr. Hayden will have headquarters in the general office of the company in Santa Cruz.

Mr. Hayden's business career started in 1920, after finishing at the University of California. For several years he worked with major oil companies in sales and merchandising departments. Fourteen years ago he came into the utility picture as a cadet. After a short period of active sales work he became district manager of Imperial District and later of Contra Costa's Division.

The manager's position in Contra Costa will be filled by **Clifford R. Hayden,** brother of R. L., who is manager of the Imperial Valley District. C. R. Hayden will in turn be succeeded by **Fred Hix,** manager of Westside Division. Mr. Hix's successor is **W. R. Snyder,** manager of Hollister District, and the new manager in the Hollister District will be **Wayne Matthews,** formerly assistant to the chief engineer in the general office in Santa Cruz.

• **Hoyt Laseter,** formerly a member of the Arkansas Natural Gas Corp.'s Shreveport operating department, has assumed the duties of safety survey engineer for the gas distribution department at Texarkana, Texas.

• **Louis F. Page,** who joined the AGA Laboratories War Products Department following his graduation from Tri-State College in 1942 as a mechanical engineer, entered the army during March. The latest member of their staff to enter the armed forces, Mr. Page represents the fiftieth Laboratories' employee now in our country's service.

• **L. E. Dequine** has been appointed general superintendent of gas operations for Jersey Central Power and Light Co., Asbury Park, taking over the duties of **John D. Alden** who was retired on March 1.

• Ill health has forced **George L. Scofield,** general new business manager, Dominion Natural Gas Co. Ltd., Buffalo, N. Y., to resign as chairman of the General Engineering and Economic Aspects Sub-committee of the Canadian Gas Association's Postwar Planning Committee. **H. W. Durgy,** division superintendent, Dominion Natural Gas Co., St. Catharines, Ontario, has been appointed to take over the chairmanship for the time being.

• The Pacific Gas and Electric Co. has announced the appointment of **Marguerite Fenner** as director of home economics for its entire system.

M. Fenner

Miss Fenner, for the past six years, successfully served the company as appliance counselor and home economist in the Sacramento division. In her new assignment she will direct the work of home economist in the various company divisions.

Miss Fenner holds a degree in B. S. in home economics from the University of South Dakota. Following graduation she was for one year home service director of Mountain States Power Co., Casper, Wyo. She then transferred to California-Oregon Power Co., Medford, Ore., which post she resigned to join Pacific Gas and Electric Co.

Miss Fenner currently is serving the Pacific Coast Gas Association as chairman of its home service committee.

• **Betty Alice Hosmer** on March 6 was appointed home service director for the Merriam branch of the Gas Service Co., Kansas City. She has been associated with this company, in various branches, since June, 1943.

• **Claudia Brant** on April 1 assumed her new duties as home service director of The Wyandotte County Gas Co., Kansas City, it has been announced by **Clarence H. Waring**, general manager of the company, and **Jess G. Tooker**, new business manager.

• Washington Gas and Electric Co., Tacoma, annouced the appointment, on March 6, of **F. R. Merris** as general manager. Associated with the firm since 1930 as secretary-treasurer, Mr. Merris has a background of 32 years in the utility field.

• **Thomas J. Heard**, secretary of the Arkansas Natural Gas Corp., Shreveport, has been elected to membership in the Controllers Institute of America. The Institute is a technical and professional organization of controllers devoted to improvement of controllership procedure.

• **Samuel Smallpage**, comptroller and director of Public Service, Inc., has been elected president of the New Orleans Control of the Controllers Institute of America. The Institute, of which the New Orleans branch is the newest local chapter, is a technical and professional organization of controllers devoted to improvement of controllership procedure.

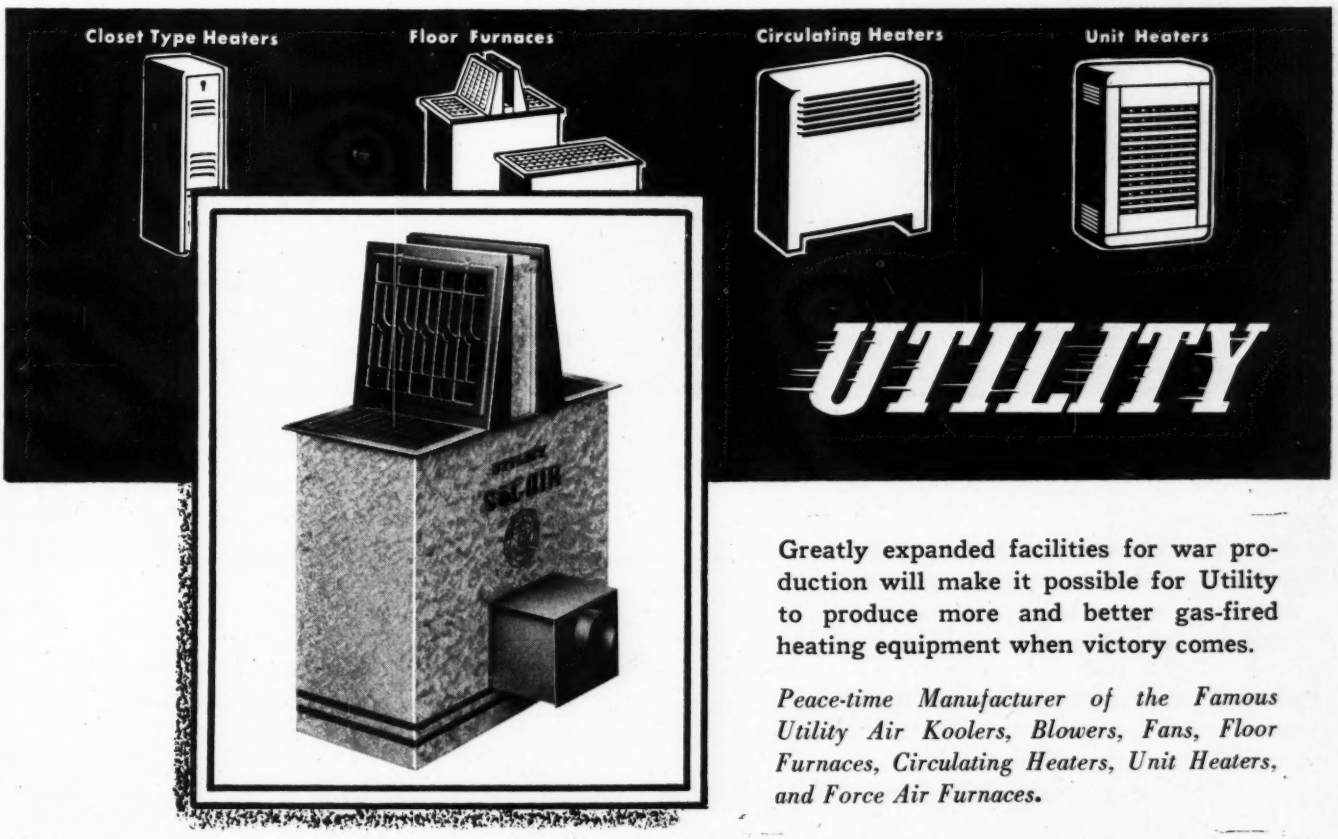
• Into the newly organized personnel department of Houston Natural Gas Corp., Houston, goes **Kenneth Fellows** as manager. Mr. Fellows also will continue in his present capacity as advertising manager.

• **Roy A. Wehe**, since 1937 chief of the gas and electric division of the California Railroad Commission, on April 1 was appointed assistant director of the public utilities department. In his new position, Mr. Wehe, a member of the Commission staff for 21 years, will assist Director **E. F. McNaughton** in the administration of the department, covering water, telephone, research, valuation, and gas and electric matters. In addition, he will be particularly responsible for the formal proceedings coming before the Commission in the public utilities department.

R. A. Wehe

Mr. Wehe first became affiliated with the Commission in 1923, spending the first seven years in the valuation division, prior to his appointment as senior engineer. He was transferred to the gas and electric division in 1930.

He is a graduate of University of North Dakota, electrical engineering, class of 1918; Massachusetts Institute of Technology, engineering administration, class of 1921; Stevens Institute of Technology, marine engineering, 1918. He served as an ensign in the navy during World War I.



Greatly expanded facilities for war production will make it possible for Utility to produce more and better gas-fired heating equipment when victory comes.

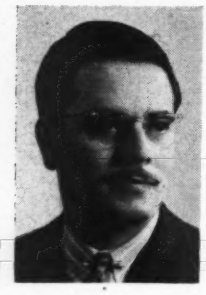
Peace-time Manufacturer of the Famous Utility Air Koolers, Blowers, Fans, Floor Furnaces, Circulating Heaters, Unit Heaters, and Force Air Furnaces.

UTILITY FAN CORPORATION

4851 South Alameda, Los Angeles 11, California

Manufacturers

• **L. S. Egea,** 1151 South Broadway, Los Angeles, Calif., announces sales-engineering affiliation with the Selas Co., Philadelphia 34, Pa., consulting and manufacturing gas engineers identified with such process heating developments as: heat-set printing; gas-air flame hardening and annealing; high-speed billet heating; radiant varnish cooking; direct-fired high temperature china kilns; radiant roof furnace firing; and gas-air production brazing.



L. S. Egea

Mr. Egea will be exclusive Selas sales engineering representative on the West Coast. He studied machincal engineering at the University of Texas, Wayne University, and General Motors Institute of Technology. He has had wide experience in the power plant and industrial furnace fields, and carries technical qualifications in the refractories, automotive, ceramic, heat treating, and enameling industries.

• **Frederick E. Moskovics** has been appointed industrial consultant to A. O. Smith Corp., Milwaukee. With 40 years of technical experience, he will be principally occupied in organizing production of the company's war products.

• At an organization directors' meeting of Bailey Meter Co., Cleveland, on March 30, **E. G. Bailey,** former president and founder was elected chairman

Robert S. Coffin succeeds him as president. Vice-president since 1925, Mr. Coffin became associated with Bailey Meter Co. as treasurer when it was organized in 1916.

Other officers elected at the meeting are: **R. E. Wooley,** vice-president, and **J. H. Black,** secretary-treasurer.

• **Dr. Thomas Dobbins,** medical director of Servel, Inc., has been commended by Secretary of Labor **Frances Perkins** for his work, during the past two years, as state chairman of the National Committee for the Conservation of Manpower in Defense Industries—a committee composed entirely of volunteer agents in the interests of promoting the need of industrial safety.

• Colonel **Willard F. Rockwell** was elected Chairman of the Board at the annual meeting of the Pittsburgh Equitable Meter Co. Colonel Rockwell, who has been president of the company since 1926, will continue as active head of the firm and serve in the dual capacity of president and board chairman.

E. W. Meyers

W. S. Potter

Susbsequently announced were the elections of **Edgar W. Meyers** as Director and **William S. Potter** as Vice-president.

Mr. Meyers, treasurer for the past 18 years, will continue to serve in that position.

Mr. Potter, formerly assistant works manager, has been with the Pittsburgh concern for the past 14 years in various engineering and production capacities.

• **Frank J. Nugent** has been named general manager of Sales, Appliance Division of the Rheem Manufacturing Co., with headquarters in New York. Mr. Nugent will be in charge of all appliance sales and sales personnel for the company's entire operations.

Obituaries

• **Guy Luneau,** 46, died at his home in Monticello, Ark., February 21. He was manager for the Arkansas Louisiana Gas Co., and had been with the firm for 18 years.

• **Russell W. Plank,** since 1938 division compressor station superintendent of Panhandle Eastern Pipe Line Co., branch at Iuka, Kan., died March 6, after a short illness. Mr. Plank had been associated with that firm in various capacities since 1930.

• **Charles S. Wagner,** 55, former representative of Detroit, Mich., Stove Co. and Pittsburgh Water Heater Co., died suddenly at his home in Kansas City.

• **Dr. Frederick G. Clapp,** 64, of Bronxville, N. Y., internationally known geologist and consultant to several foreign governments, died February 18 in Chickasha, Okla. From 1911 to 1915 he was petroleum and natural gas expert for the Canadian Department of Mines, and later was instructor in geology at Massachusetts Institute of Technology.

•

Texas Prohibits Sweet Gas Use for Carbon Black

The Texas Railroad Commission has issued a formal order prohibiting the use of sweet gas for the making of carbon black by the channel process.

The order suggests that channel black plants in the Panhandle sour gas area are not being fully utilized and that large quantities of casinghead gas produced with oil are available to the carbon black industry in that area.

SEMET-SOLVAY
ENGINEERING CORPORATION

Blue Gas Plants
Water Gas Machines
Washer Coolers
Naphthalene Scrubbers
Gas Purifiers
Condensers
Waste Heat Boilers
Producer Gas Plants

40 RECTOR STREET, NEW YORK, N. Y.

OVER THERE ★

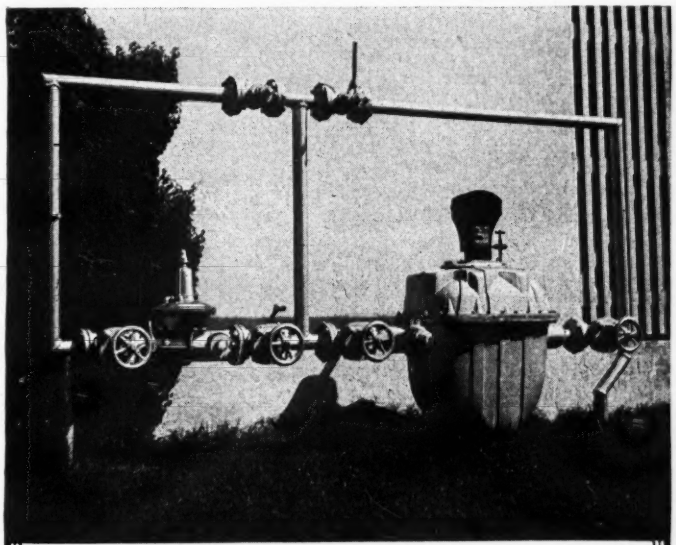
Because the Spencer Snap-Acting Disc is urgently needed in controls for war, they are no longer available to manufacturers of gas equipment. Instead, they're "over there" in tanks, planes, trucks, helping to win Victory.

SPENCER THERMOSTAT CO. • *Attleboro, Mass.*

KLIXON

REYNOLDS *gas* REGULATORS

INSURE HEAT TREATING ACCURACY BY ACCURATE GAS CONTROL



In the above installation the Reynolds Regulator reduces the inlet pressure of 25 pounds to five pounds.

REYNOLDS builds a Regulator for every type of Gas Control Installation. Proved by records of performance in actual operation or by records of factory tests on new developments, every REYNOLDS unit—whether for high pressure or low—is a proved product.

Long life, efficient operation, accurate regulation, reasonable cost, low upkeep—these are vitally important inherent features built into REYNOLDS Gas Regulators through more than 50 years of experience in developing, designing, building and testing Gas Control equipment.

For full cooperation of our Engineering Department, write our Factory, Branch Offices, or Representatives.

Representatives

Eastern Appliance Co.
Boston, Massachusetts

Wm. A. Ehlers
No. 268 Park Street
Upper Montclair, N. J.

Branch Offices

423 Dwight Building
Kansas City, Missouri

2nd Unit:
Santa Fe Building
Dallas, Texas

REYNOLDS GAS REGULATOR CO.

Anderson, Indiana, U. S. A.

GAS CONTROL SINCE 1892

- ✓ **Ideal for gas-burning appliances**
- ✓ **Light weight—easy to install and support**
- ✓ **Can't Rust**
- ✓ **Needs no painting**
- ✓ **Relatively low heat conductivity**
- ✓ **Available both round and oval**
- ✓ **Full range of sizes, 2" to 12"**
- ✓ **Complete line of Fittings and Accessories**

For details write for brochure TR-13A. Johns-Manville, 22 East 40th Street, New York 16, New York.

JOHNS-MANVILLE JM PRODUCTS

JOHNS-MANVILLE

TRANSITE FLUE PIPE

For venting gas-burning appliances

What's Ahead in Gas Heating Equipment?

Ask our postwar planning department. Right now, while our shop is up to the hilt in war work, our research engineering and sales executives are blueprinting an improved complete line of *Hammel* residential, commercial and industrial equipment.

Operating under the management and ownership of A. S. Martinson and S. D. Crozier, we are now formulating plans to introduce this new line Nationally.

HAMMEL
Radiator Engineering Co.
Successors to Hammel Radiator Corp.
3348 Motor Ave., Los Angeles 34, Calif.

PIPE ACCORDING TO THE A. S. A. LAW OF DESIGN

Mono-Cast Centrifugal Pipe can be manufactured in specific weights for specific laying conditions, and in accordance with the recently adopted A. S. A. Law of Design. You get the EXACT pipe your conditions call for.

PROMPT DELIVERIES with suitable priorities.

American Cast Iron Pipe Company
BIRMINGHAM 2, ALABAMA
Sales Offices in Principal Cities

What Is Your Company Doing to Capture That Post-War Commercial Cooking Load?

THE best starting point for intelligent and effective planning for post-war action in the commercial cooking and baking fields is a survey and analysis of the market as its exists today.

To foster activity in this direction, Roy E. Wright, chairman, food service equipment committee, Industrial and Commercial Gas Section, of the American Gas Association, has recently submitted a report prepared by the subcommittee on local surveys, Harry A. Sutton, chairman.

The committee has given considerable thought to the kind of information desired in such a study. As a result it has produced a guidance survey form to be used by the individual gas companies as a guide in preparing their own forms.

The suggested survey form would provide the local gas companies with the following kinds of information:

1. Average number of meals served, and their price range. (This will assist the company in determining whether or not the present equipment is adequate.)
2. Periodicals received or subscribed to. (A basis for placing advertising and publicity).
3. Record of equipment in use. (A basis for planning direct mail advertising).
4. Average use of gas service per month, average rate earned and revenue received. (A basis for establishing service policies).
5. The number and kinds of appliances used, and a check on appliance adjustments. An indication of the types of fuel used with this equipment. (A basis for determining potential business, and a guide for advertising and service policies).
6. A tabulation of information on process steam, hot water, space heating, refrigeration and summer air conditioning used. (A guide to potential business).
7. An indication of reasons why certain loads were lost to competitive fuels. (A guide to regaining business lost).
8. Customers' opinion and surveyors' comments. (A guide to public relations policies).

A survey of this kind will involve much time and effort, and some companies may feel they cannot spare manpower to make it. The committee believes, however, that the importance of this load to every gas company merits the provision of men to conduct it.

But the collection of essential, factual data is only the beginning. A careful analysis of the data obtained should include the following information to serve as a basis for conferences with manufacturers of equipment to insure the availability of equipment required:

1. How many of each type of appliance should be replaced as soon as possible?
2. How many of each type of appliance will be needed as additional equipment or for replacement of competitive equipment.
3. What amount of gas (Mcf. per year) and revenue should be considered potential load?

In addition, the individual gas companies should record and analyze the following facts:

1. How many sales representatives will be needed to do the job?
2. What advertising should be sent, and to whom should it go?
3. What changes in servicing policy are advisable?
4. What business is available in the fields of water heating, space heating, refrigeration, and air conditioning?
5. What can be done to eliminate reasons for loss of business to competitive fuels?
6. What can be done to improve customer relations?

Later reports of the Food Service Equipment Committee will include specific information on the following phases of the post-war program: customers' service; dealer cooperation; selling technique; engineering or technical service; advertising; publicity, and research, and development.

In the meantime, the committee offers its services in answering to the best of its ability any specific questions which individual companies may wish to direct to it. It will also welcome any suggestions for improving the proposed program.

Southern California Gas Co. Remodels House Organ

The first issue of **Gas Newsweek Pictorial,** successor to Southern California Gas Co.'s **Gas News,** and supplementary to the joint bi-weekly newspaper of that company and Southern Counties Gas Co., appeared in March. It is a 16-page leaflet, edited by Otto C. Mauthe and J. T. Van Rensselaer, devoted to articles of general and educational interest to the company's employees, with an emphasis on pictorial material.

Gehnrich Corp. Bought By W. R. Rockwell Co.

Charles B. Kentnor, president of W. S. Rockwell Co., New York City, has announced that the business of the Gehnrich Corp., recently purchased by his company, will be operated as that company's Gehnrich Oven Division. According to Mr. Kentnor, the Gehnrich engineering, manufacturing and sales personnel will be retained in the new organization.

Two New Domestic Research Bulletins Published

Two more bulletins, covering special phases of domestic cooking and burner research, resulting from the accelerated program of fundamental research being conducted by the American Gas Association at its testing laboratories, are now available.

The first, "Single Point Flash Tube Ignition of Oven and Broiler Burners," is known as Research Bulletin No. 21. The fifth of a series on domestic gas cooking, it is a sequel to Bulletin No. 17 which presented a comprehensive study of the fundamentals of flash tube oven ignition using manufactured gas. The new bulletin extends the study to the field of natural gas, the utimate goal being design of flash tubes providing effective ignition with natural, mixed and manufactured gases.

The second bulletin, "Primary Air Control Devices for Atmospheric Gas Burners," is designated Research Bulletin No. 22. It is the fifth of a series on burner research. It presents extensive data covering studies of different means of controlling primary air injection with Bunsen burners and tests made to determine the relative merits of various types of primary air adjustment devices in resisting reduction of initially regulated air-gas mixture ratios as a result of dust and lint stoppage.

PUAA Better Copy Contest To Close This Month

The 1944 Better Copy Contest, sponsored by the Public Utilities Advertising Association, is now in progress, according to C. J. Allen, chairman of the contest. All public utilities are cordially invited to submit material. Membership in the Public Utilities Advertising Association is not a requirement for entrance. The current contest is to include material published between January 1, 1943 and December 31, 1943.

The annual Better Copy Contest was inaugurated in 1924 and is the oldest advertising competition in existence today. A total of 125 companies have won 550 awards since the contest was inaugurated. From 3000 to 7000 individual advertisements are submitted each year, and awards made by competent judges of outstanding reputation are announced at the annual meeting of the Public Utilities Advertising Association.

The awards in the current contest will be made on June 6-7-8 at the Association's annual meeting, which will be held at the Palmer House in Chicago. Annual awards in various classifications are published each year in folio form, and contestants are given the opportunity to study the best advertising of the entire industry.

The rules and regulations for entering the contest are explained in the booklet which may be procured through the chairman, The Connecticut Light & Power Co., 250 Freight St., Waterbury, Conn.

Koppers Co. Sells Interest In Brooklyn Union

Through the sale of 177,940 shares of Brooklyn Union Gas Co. stock, the Koppers Co. brought to an end a stock ownership in this company dating back to the 1920's. The Koppers' holdings represented 23.87% of the Brooklyn Union shares outstanding.

Since the sale was made to several investors, Brooklyn Union can no longer be considered a statutory subsidiary under the definitions of the Securities and Exchange Commission.

Public Utility Motor Vehicle Conference in Philadelphia

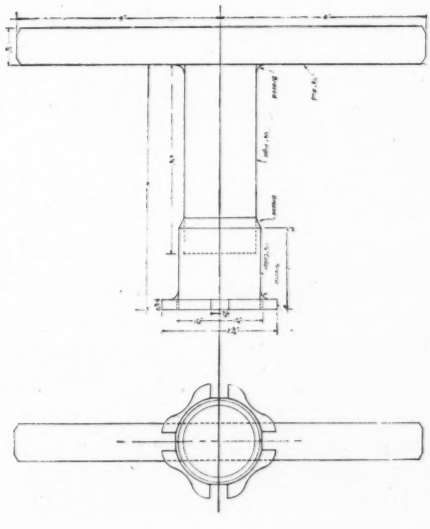
E. W. Jahn, Consolidated Gas Electric Light & Power Co. of Baltimore, chairman of the AGA Committee on the Operation of Public Utility Motor Vehicles, has announced that the committee's annual conference will take place on the day preceding the Philadelphia T and M meeting of the society of Automotive Engineers, June 27, 1944, at the Bellevue-Stratford Hotel, Philadelphia.

Regulator Wrench for Low Pressure Valves

Developed by JOHN PRICE, district welder, and submitted to "G A S" by A. H. COX, Houston Pipe Line Company.

This wrench was made by using a short piece of 1¼-in. pipe having a piece of flat iron fitted and brazed on one end and cut out to make the prongs which fit against the valve guides. The other end of the 1¼-in. pipe has a cross bar or handle made of ½-in. pipe.

The wrench was made primarily for a 4-in. low pressure Chaplin Fulton weight type having a double seated valve or plug which has removable rubber inserts and guides which screw on tight against the rubber inserts. Using this wrench makes it easy to remove the guides and doesn't scar up the working surface.



BACK FROM SERVICE

G A S is glad to do what it can to help utility men who have returned from service in the armed forces to establish themselves once again in the industry. The name, address and qualifications of those seeking positions will be listed below. This service is open to all who wish to use it. Please address information to G A S Magazine, 1709 West Eighth Street, Los Angeles 14, Calif.

Harold Joe Davis, 4212 So. 26 West Ave., Tulsa 7, Okla.; age 34.

War record: Mr. Davis has served the military forces in the field of fire administration, which included organization, planning, directing, training, purchasing of necessary equipment, investigations, etc.

During the Japanese raids on Dutch Harbor, he was engaged in establishing fire protection at that base. While the base was under attack, he had the task of directing all fire-fighting operations. Injured during the attack, he has now recovered and is seeking a position with a progressive organization.

Experience: During 1930-1941 Mr. Davis who holds a B. Sc., was consultant and adviser to industrial managements on problems of fire protection. From 1941 to the present date, he has been in government service in the field of fire administration. Mr. Davis also is an experienced lecturer and the author of the booklet, "Fire! Its Cause, Prevention, and Control."

Chicago Co. Reduces Debt

For the first time in 45 years, Peoples Gas Light & Coke Co., Chicago, has reduced its outstanding debt to a ratio of less than 50% of total capitalization, according to a report issued by George A. Ranney, chairman.

During the past 11 years, debt has been reduced $30,527,100 from a $92,777,100 peak.

In the past month the Chicago utility has sold the Chicago By-Products Corp., a subsidiary, to Socony-Vacuum Oil Co, for $142,500.

Following the policy of simplification of corporate structure, the company now has only four subsidiaries, two of which, Ogden Gas Co., and Universal Gas Co., will be eliminated in 1945 or shortly thereafter.

Gas Conversion to Oil Hinted

The United States has very large supplies of natural gas which could be converted into oil products if the need arose, in the opinion of Walter L. Faust, vice president of Socony-Vacuum Oil Co. Faust made this statement in a speech late in March at Syracuse, N. Y., before 300 industry and government representatives attending an oil-war conference of the Empire State Petroleum Association. Faust expressed belief the world would have an adequate petroleum supply until at least the year 3026.

CURRENT READING

Measuring the Flow of Fluids—W. Goodman. "Heating, Piping and Air Conditioning," Jan., 1944, pp. 8-10. Article 6. Author discusses the construction of a U-tube manometer and its proper application.

The "Big Inch" Pipe Line—W. R. Finney and J. B. Adoue. "Petroleum Engineer," Jan., 1944, pp. 185, etc. Why 24 in. was the only logical size is explained in this article.

Phase Equilibria in Hydrocarbon Systems—H. H. Reamer, R. H. Olds, B. H. Sage and W. N. Lacey. "Industrial and Engineering Chemistry," Jan., 1944, pp. 88-90. The volumetric behavior of four mixtures of methane and carbon dioxide was studied at seven temperatures ranging from 100° to 460° F. and throughout the pressure interval from 100 to 10,000 lbs. per sq. in. In addition, the volumetric behavior of carbon dioxide was investigated as a check upon the purity of the sample and the methods of measurement.

Silencers for Diesel and Gas Engine Compressor Sets—R. B. Bourne. "California Oil World," 2nd Jan. issue, pp. 13-17. Author discusses the noise problem and some of the factors which have to be taken into account in the design of a suitable exhaust system, and then describes the design of silencer.

Propane, Normal and Iso-Butane Recovered in Gas Treating Plant—H. L. Phillips. "National Petroleum News," Jan. 5, 1944, pp. R-16, 18. Propane, butane and iso-butane of over 95% purity, in addition to natural gasoline, are recovered as by-products of a plant extracting hydrogen sulfide from sour gas produced in southern Arkansas. The gas is passed through the purification and absorption units, the enriched oil after the stripped gas has been removed being treated in a heater, still and series of fractionators.

Foreign Processes for the Conversion of Methane to Hydrogen and Carbon Monoxide—H. Heinemann. "Petroleum," Jan., 1944, pp. 35, 36. A brief review of the various processes.

Efficiency of Compressor Operation Increased by Auxiliaries—E. C. Powers. Petroleum World, Jan., 1944, pp. 30-33. In economical operation, aftercoolers, filters and other protective devices are indispensable.

Patent Law—by Chester H. Biesterfeld, published by John Wiley and Sons, Inc., New York, N. Y.

Covering the basic principles of patent law, this volume is designed particularly for chemists, engineers, and students. In order that the subject could be made clear to those without professional legal training, considerable space is devoted to analyses and classification of the decisions on certain cases. Recent decisions of the court bearing on the various subjects treated are included.

The value of the book is evident from the fact that 80 to 90 per cent of the patents coming before the courts in recent years have been held invalid. A greater knowledge of the principles of patent law appears necessary.

Ash Structure in Coke—Louis Shnidman (Rochester Gas & Electric Corp.). "Industrial and Engineering Chemistry," Dec., 1943. A study of a series of thin sections of coke with and without the admixture of breeze, both before and after burning. It was found that the distribution and structure of ash in coke in relation to the combustible was dependent on the structure of the original coke, and that the combustible material surrounds and envelops the ash residue.

Planning Gas Compressor Stations for Long-Range Efficiency—B. Thiel. "National Petroleum News," Feb. 2, 1944, pp. R-87, 88, 90, 92. The increasing use of refinery gases and gas derivatives in the manufacture of petroleum products, the recovery of light compounds in natural gasoline plants and the growth of recycling operations in oil fields point to additional gas compressor stations in the future, despite the large number of wartime compressor installations. Factors to be considered in designing stations for long-range efficiency, stability and economy are outlined as a basis for meeting the particular problems of the individual installation.

Volume Control and Regulation of High-Pressure Gas—E. H. Short, Jr. "Oil and Gas Journal," Feb. 10, 1944, pp. 68, 69 Regulation of high-pressure gas flow is complicated by a number of problems, chief of which has to do with the selection of suitable volume-control mechanism. Various types of equipment have been tried, some of which have proved more applicable than others. The applicability of some of these types to particular conditions is discussed in this article.

Geologic Formations and Economic Development of the Oil and Gas Fields of California—Prepared under the direction of Olaf P. Jenkins, and published by State of California Department of Natural Resources, Division of Mines. 773 pp. The theme of Bulletin 18, the above volume, is geology. In all, 126 geologists have contributed articles for the bulletin. Maps, sections, charts and pictures augment the text. Rock names are briefly defined and accompanied by selected citations in a glossary of geologic units. Accompanying the volume is an economic state map, showing the locations of the oil and gas fields and other drilled areas. The book is arranged in four parts: Development of the Industry, Geology of California and the Occurrence of Oil and Gas, Descriptions of Individual Oil and Gas Fields, and Glossary, Bibliography and Index.

A. P. I. Announces Annual Petroleum Reserves Figures—"Oil Weekly," Feb. 28, 1944, pp. 14, 15. Comparatively encouraging report shows U. S. proved reserves drop only 18,000,000 bbls., in year to 20,064,152,000 bbls.; discovery rate of new oil, however, continues downward.

MUELLER "N" DRILLING MACHINE

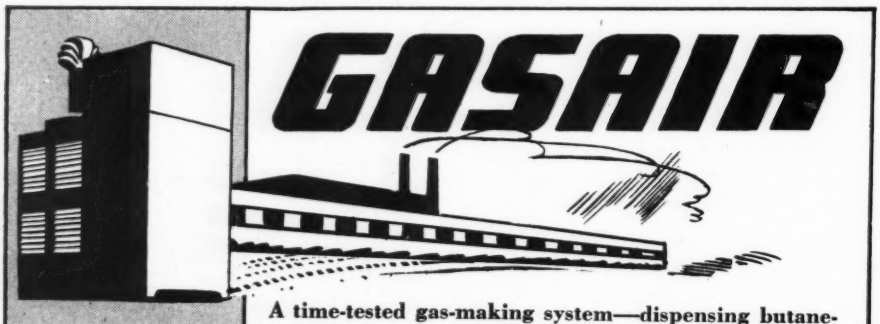
Ideal for drilling through gate valves — sizes 2" to 4" inclusive — under high pressure.

For cutting in laterals, large services, etc.

Light Weight Ruggedly Built Write Dept G-81

MUELLER CO. Decatur, Ill.

GASAIR



A time-tested gas-making system—dispensing butane-propane and air mixtures under rigid b.t.u. control —for stand-by or permanent operation.

GASAIR CORPORATION 1072 BRYANT STREET SAN FRANCISCO, CALIF.

Washington Orders

Electric, Gas, Water and Central Steam Heat Utilities: (Amendments to Supplementary Utilities Orders U-1-c, U-1-d, U-1-f, and U-1-h.)

U-1-f: Restriction on extensions of service primarily to serve cooking appliances has been deleted from the order. Extensions to serve cooking appliances may now be made on the same basis as any other extension.

Gas connections to serve lessors of property on which producing natural gas wells have been completed are now permitted.

Extensions of service to all classes of industrial and commercial consumers as wholesale and retail establishments, physicians' offices, and restaurants, which were not previously provided for in the order are now permitted. Refer to section B I and B II of the Utilities Construction Standards for information as to the materials that may be used.

The Utilities Construction Standards have been revised. The complicated tests for determining the quantities and kinds of pipe used in extensions of service under U-1-f are no longer applicable. A total of 350 ft. of pipe may be used in one domestic extension (500 ft. for certain commercial and industrial extensions, no footage limit as to others) irrespective of the kind of pipe proposed to be used, and of whether the extension is of main or of service. The one exception to this rule is where copper or copper base alloy pipe or tubing is to be used. A recent amendment to Order M-9-c-4 has released copper pipe or tubing for use in extensions of service of this kind, provided that the pipe or tubing was in inventory prior to January 1, 1944. Order U-1-f limits the length of such pipe or tubing for a domestic installation of gas or water service to the amount necessary to reach from the main to the curb stop or consumer's property line. Of course the length of copper pipe or tubing used must be included in calculation of the footage limitation on total length.

U-1-h: A radical change has been made in the provisions of this order in that it no longer permits the construction of any extensions unless they are for the purpose of serving consumers the construction of whose premises requires approval under L-41 or consumers whose premises are to be occupied exclusively by the Army, Navy, Maritime Commission, War Shipping Administration, or Civil Aeronautics Authority.

Welding Equipment: WPB revokes the requirement that owners of used, idle resistance welding equipment available for resale report their stocks to the WPB.

Refrigeration: WPB's general refrigeration and air conditioning industry advisory committee adopts this pattern for present and future studies of the industry: (1) Consideration of production permitted under present WPB policy and (2) a procedure for study of products and their relation to requirements under various stages of future material relaxations.

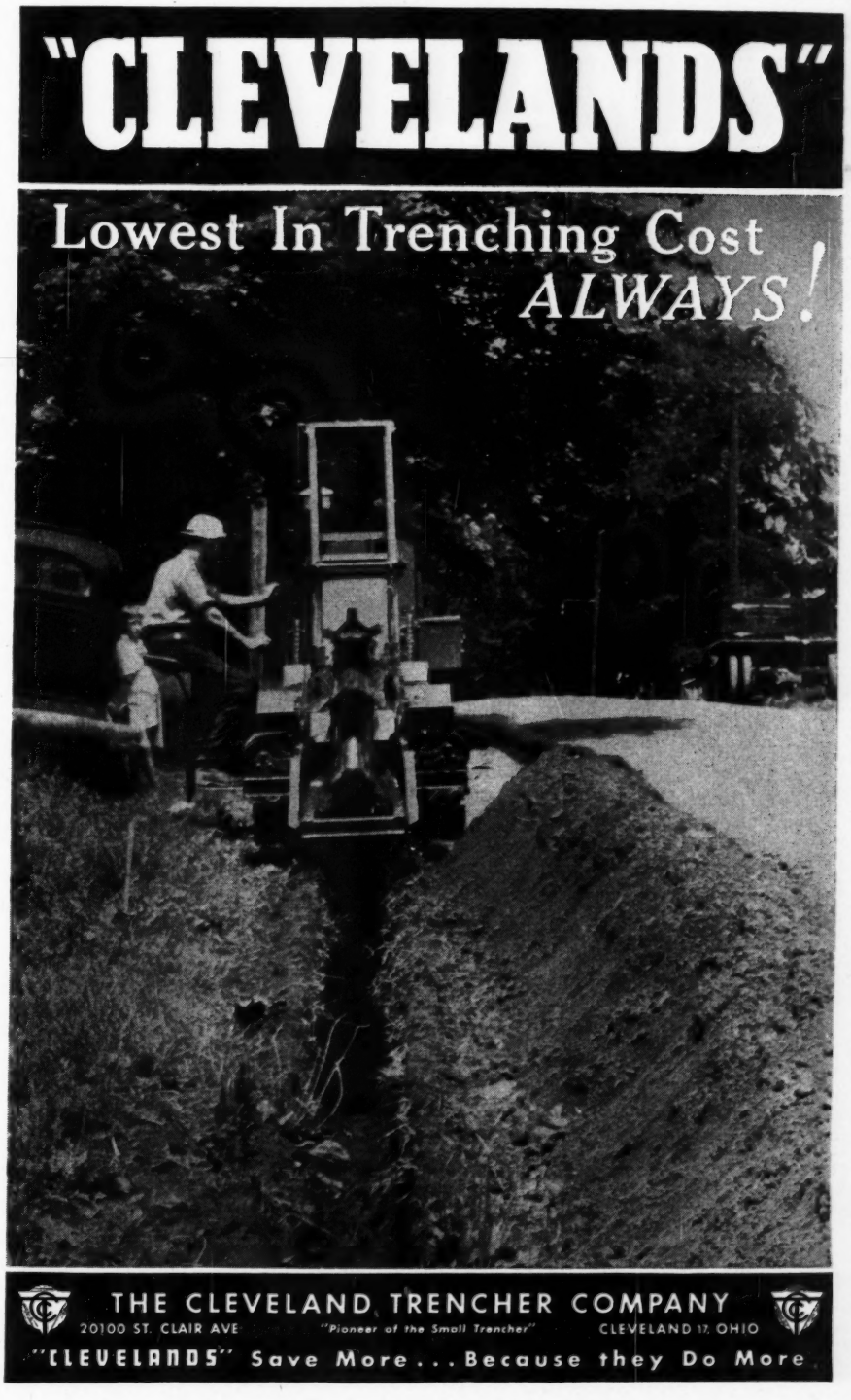
Petroleum Gas: Tighter restrictions on the use of liquefied petroleum gas equipment and a prohibition against the use of liquefied petroleum gas as a motor fuel in passenger automobiles are announced by Deputy Petroleum Administrator Ralph K. Davies.

Plumbing and Heating Equipment: WPB prohibits substitution of one type of heating system for another if the substitution requires the replacement of a usable distribution system. (Order L-79, as amended), issued April 13.

Cooking Ranges: Specific ceiling prices for used gas cooking ranges are announced by the OPA, covering all sales and purchases, including sales by a consumer who is selling his own range, and sales by dealers and auctioneers. (MPR 527 and Amendment 3 to MPR 429), effective April 19.

"Thanks Mom" Ad Cited

For the second time within the year the gas industry's national advertisement, "Thanks Mom," first published in March, 1943, received special recognition for its effectiveness in promoting the civilian war effort. On this occasion it was selected as one of the hundred best advertisements represented in the Wartime Advertising Awards.


"CLEVELANDS"
Lowest In Trenching Cost
ALWAYS!
THE CLEVELAND TRENCHER COMPANY
20100 ST. CLAIR AVE
"Pioneer of the Small Trencher"
CLEVELAND 17, OHIO
"CLEVELANDS" Save More . . . Because they Do More

Gas Combustion and Control Equipment

THE
WEBSTER ENGINEERING COMPANY
Tulsa, Oklahoma

Consulting Engineers and Manufacturers

Division of
SURFACE COMBUSTION

TOLEDO, OHIO

SINCE 1897
BEST IN BRASS

K-CO

GROUND KEY Gas & Steam Valves

TEMPERATURE and PRESSURE Relief Valves

GAS SHUT-OFF Valves

A wholly owned subsidiary of WELSBACH ENGINEERING AND MANAGEMENT CORPORATION.

WELSBACH

KITSON COMPANY
1500 WALNUT STREET
PHILADELPHIA 2

Los Angeles Plant Built By Connelly Iron Sponge

CONNELLY IRON SPONGE & GOVERNOR CO. of Chicago, manufacturers of gas purifying materials and apparatus, has just announced the opening of its new Pacific Coast plant, located at 540 Bouchet street, Los Angeles, Calif.

This plant was put into production in record time to supply the emergency gas purification needs of the Southern California Gas Co.'s Butadiene plant.

Ground was broken for the plant on March 25, and the first shipment of Connelly iron sponge was ready for delivery by May 1. R. W. Stafford, Connelly chief engineer, has been on the West Coast for the past six weeks, devoting full time to planning, laying out, and putting the plant into production. The plant manager of the Connelly West Coast branch will be James J. Cuddihy, who has been with the Connelly organization for the past 22 years, working up to the position of plant superintendent at Chicago.

With the establishment of the West Coast branch, Connelly Iron Sponge & Governor Co. is now in a position to furnish purifying materials and apparatus from coast to coast. Other plants being operated are at Elizabeth, N. J. and Chicago, Ill.

Ebasco Simplification Sought

The Houston Gulf Gas Co., a subsidiary of United Gas Corp. in the Electric Bond and Share Co. system, has asked the Securities and Exchange Commission for permission to sell its production properties, all located in Texas, to the Union Producing Co. for $3,049,155.09. A portion of the proceeds would be used by Houston Gulf in payment of the remaining face amount of $1,800,000, plus accrued interest, of a note held by First National Bank of Boston. United Gas Pipe Line, as owner of the outstanding capital stock of Houston Gulf, said it would merge Houston Gulf into United Gas Pipe Line as part of the plan.

WANTED

Man with engineering background having thorough knowledge of modern high and low pressure gas distribution practice, cleaning, dehydration, sizing of equipment, plant layout. Permanent position with large manufacturer. Write giving full transcript of experience. Box 270, c/o GAS, 1709 W. 8th, Los Angeles 14, Calif.

WANTED
Designing Engineer

Exceptional opportunity for permanent position with Cribben and Sexton Company, one of the major gas range manufacturers. Must be experienced in gas range design and product development. Must have the ability to coordinate design problems, performance requirements, with field problems and production operation. Must be graduate engineer. Give complete details as to qualifications, age, experience, education.
Apply Personnel Department, Cribben and Sexton Company, 700 North Sacramento Blvd., Chicago, Ill.

NEW GAS PRODUCTION

• Natural gas production in Canada in January, 1944, amounted to 5,136,573 mcf as compared to 5,476,191 mcf in the same month of last year and 4,844,503 mcf. in December last, according to a monthly report issued from Ottawa by the Dominion Bureau of Statistics.

• According to the annual report of **McColl-Frontenac Oil Co. Ltd.**, released in Montreal, Quebec, early in April, the company filed natural gas and petroleum reservations over 800,000 acres in western Canada in 1943. The report says that extensive geological and geophysical surveys were undertaken, and from the result of this work it was decided to drill in an area along the International border in the province of Alberta. The report adds that the company has spent $700,000 on its western Canada exploration program so far without definite results, but that it is felt these efforts should be continued.

• **Standard of California** announced on April 17 its completion of a small discovery gas well on the north shore of Suisun Bay near San Francisco.

The well, Honker 1-A, produced natural gas of good quality from a depth of 7246 ft., and was drilled on a 6200-acre community lease from duck clubs owned by Bay Region sportsmen. The nearest gas production is approximately 11 miles to the northwest in the Rio Vista field.

In testing the area, the company had previously drilled four wells ranging in depth from 5440 ft. to 8728 ft. All the wells showed some gas, but in none was a significant amount obtained until Honker 1-A was brought in.

It is planned in the near future to prospect on the Fontana Farms 13,000-acre lease and on the Suisun Community 10,000-acre lease to the north and northwest of the present well.

• The quest for oil in South Dakota which was begun on a big scale three years ago will be continued in 1944 with at least nine test wells planned for this summer, according to John P. Gries, associate professor of geology at the South Dakota School of Mines and Technology at Rapid City.

If the plans are carried out 1944 will be the state's biggest oil exploratory year in history.

First well to get under way this year is expected to be spudded in soon near Gustave in Harding county by the Kerr-Lynn Co. of Oklahoma City, who are to drill the well under a unit agreement.

Failure of several tests in the state during the last three years does not seem to have dimmed the interest of a number of major oil companies in South Dakota. Substantial new leasing was reported in the state during the winter and a flurry of new leasing operations is expected this spring.

Several million acres of land are now under oil lease in South Dakota and its sister-state of North Dakota.